Reference Manual

Allen-Bradley

CENTERLINE Motor Control Centers with IntelliCENTER Technology Using an EtherNet/IP Network

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Rockwell Automation

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New and Updated Information

This manual contains new and updated information. This table contains the changes made to this revision.

Topic	Page
Updated the industrial Ethernet switch options.	16
Updated the industrial Ethernet switch mounting locations.	16
Added information about unit-mounted industrial Ethernet switches.	19, 25, 29, and 62

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About This Publication

This manual describes the Allen-Bradley® IntelliCENTER® EtherNet/IP motor control center (MCC) with a focus on the system architecture and integration into your plant.

Terminology

This table defines abbreviations that are used in this manual.

Abbreviation	Full Term	Definition
ADC	Automatic Device Configuration	Feature to provide automatic intelligent device configuration
AOP	Add-on Profile	Studio 5000 Logix Designer® application tool that is used to integrate devices into the programming environment
BOOTP	Bootstrap Protocol	Computing protocol that is used to assign automatically an IP address to network devices
CIP	Common Industrial Protocol	Industrial protocol for industrial automation applications that are supported by ODVA
CLI	Command Line Interface	Tool that lets you use text-based commands to configure a Stratix™ switch
CNA	Cisco Network Assistant	Cisco tool that offers advanced options for configuring and monitoring multiple infrastructure devices, including switches, switch stacks, routers, and access points
CPwE	Converged Plant-wide Ethernet	A Cisco and Rockwell Automation collaboration to provide recommendations and guidance to help the following: – Reduce network latency and jitter – Increase the availability, integrity, and confidentiality of data – Design and deploy a scalable, robust, secure, and future-ready EtherNet/IP network infrastructure
DHCP	Dynamic Host Configuration Protocol	Networking protocol that is used to distribute network parameters such as IP addresses to connected devices
DLR	Device Level Ring	Ring network topology that is used at the device level
DM	Device Manager	Cisco tool that is used to manage network switches
EDS	Electronic Data Sheet	File that contains all parameters for a specific device
IDMZ	Industrial Demilitarized Zone	A buffer between the Enterprise and Industrial zones that provides a barrier between the zones, but allows for data and services to be shared securely.
IEEE	Institute of Electrical and Electronics Engineers	Organization that standardizes electrical engineering practices
IGMP	Internet Group Management Protocol	Communication protocol that is used to establish IP multicast groups on a network
IMC	Intelligent Motor Control	Motor control devices that can connect to a communication network
IOS	Internet Operating System (Cisco)	Cisco software that runs on the Stratix family of switches
MAC	Media Access Control	The MAC ID is a hardwired unique identifier that is assigned to all network capable hardware at the time of production
MCC	Motor Control Center	A motor control center is an assembly of one or more enclosed sections having a common power bus and contains motor control units. A motor control center can include variable frequency drives, programmable controllers, and metering units.
ODVA	—	Organization that standardizes communication networks that use CIP among other technologies
PAC	Programmable Automation Controller	Multidiscipline controllers that are used across manufacturing disciplines such as discrete, continuous process, batch, drive, motion, and safety.
REP	Resilient Ethernet Protocol	Redundant network topology protocol/feature in the Stratix 5700™ switch
SFP	Small Form-factor Pluggable	A compact, pluggable transceiver that is used for fiber-optic Ethernet connections
STP	Spanning Tree Protocol	Network protocol that controls the transportation of information to help ensure there are no data loops
TCP	Transmission Control Protocol	Internet protocol that provides reliable delivery of information with an error-checking feature
VFD	Variable Frequency Drive	Motor controller drive that is able to change frequency that controls speed
VLAN	Virtual Local Area Network	Tool that is provided in Layer 2 switches that allows similar networked devices to be grouped in a broadcast domain

Additional Resources

These documents contain more information about related products from Rockwell Automation.

Resource	Description
Converged Plant-wide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001	Describes how to design a converged plant-wide Ethernet network.
EtherNet/IP Media Planning and Installation Manual ODVA Pub. 148 and EtherNet/IP Network Infrastructure Guidelines ODVA Pub 35(1)	Describes EtherNet/IP media planning.
Fiber-optic Infrastructure Application Guide, publication ENET-TD003	Describes fiber-optic infrastructure.
CENTERLINE® 2100 Motor Control Center with IntelliCENTER Technology Using an EtherNet/IP Network Technical Data, publication 2100-TD031	Describes cable system construction and components that are associated with an EtherNet/IP network that is factory installed in CENTERLINE 2100 and IntelliCENTER motor control centers (MCCs).
CENTERLINE 2500 Motor Control Centers with EtherNet/IP Network Technical Data, publication 2500-TD003	Describes cable system construction and components that are associated with an EtherNet/IP network that is factory installed in CENTERLINE 2500 and IntelliCENTER motor control centers (MCCs).
IntelliCENTER software user manual, publication MCC-UM002	Provides information on installation and use of IntelliCENTER software.
Resilient Ethernet Protocol in a Converged Plant-wide Ethernet System (CPwE), publication ENET-TD005	Describes REP in a converged plant-wide Ethernet network.
Stratix 5700™ Industrial Ethernet Switch Product Profile, publication ENET-PP005	Provides Stratix 5700 switch information.
Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007	Provides Stratix 5700 switch information.
PowerFlex® 750-Series AC Drives, publication 750-PM001	Provides PowerFlex 755 drive information.
PowerFlex 525 Adjustable Frequency AC Drive User Manual, publication 520-UM001	Provides PowerFlex 525 drive information.
E1 Plus EtherNet/IP Side Mount Module User Manual, publication 193-UM012	Provides E1 Plus™ relay information.
E3 and E3 Plus solid-state Overload Relay User Manual, publication 193-UM002	Provides E3™ and E3 Plus™ overload relay information.
Bulletin 193/592 E300 Overload Relay User Manual, publication 193-UM015	Provides E300™ overload relay information.
SMC Flex User Manual, publication 150-UM008	Provides SMC™ Flex controller information.
Integrated Architecture® Builder (IAB)	Provides EtherNet/IP network performance and Logix controller utilization estimates based on a particular system layout via the advanced EtherNet/IP capacity tool (system sizing tool) embedded in IAB.
Industrial Automation Wiring and Grounding Guidelines, publication 1770-4.1	Provides general guidelines for installing a Rockwell Automation industrial system.
Product Certifications website, http://www.ab.com	Provides declarations of conformity, certificates, and other certification details.

(1) For ODVA publications, see the ODVA EtherNet/IP library at http://odva.org/Home/ODVATECHNOLOGIES/EtherNetIP/EtherNetIPLibrary/tabid/76/lng/en-US/Default.aspx

You can view or download publications at http://www.rockwellautomation.com/literature/. To order paper copies of technical documentation, contact your local Allen-Bradley distributor or Rockwell Automation sales representative.

IntelliCENTER EtherNet/IP Motor Control Center Overview

IntelliCENTER Technology Overview

The IntelliCENTER® EtherNet/IP MCC couples the reliability of the CENTERLINE® 2100 and 2500 MCCs with the addition of the EtherNet/IP network, Intelligent Motor Control (IMC) devices, and IntelliCENTER software. This intelligent solution integrates seemlessly into your plant floor to let you effectively monitor and maintain your MCC.

Benefits of an IntelliCENTER EtherNet/IP MCC include the following:

- Faster Integration - EtherNet/IP network is a preconfigured, robust, and reliable network
- Faster installation when compared to hard-wired I/O
- Control and diagnostics - State-of-the-art intelligent-motor control provides crucial feedback from motors and intelligent devices
- Precise control with intelligent motor control devices - Lets you optimize your application
- More information – where you need it when you need it - Enhances your plant-asset management system
- Improved uptime - warnings in advance of failures; troubleshooting tools and information available to you

Integrated EtherNet/IP Network

IntelliCENTER MCCs use the EtherNet/IP network to connect the IMC devices in your MCC application to the rest of your plant-wide network. The EtherNet/IP network is an industrial version of an Ethernet network. The network provides one robust and reliable network solution for your entire plant from the site operations to the MCC.

The integrated EtherNet/IP network within your IntelliCENTER MCC is preconfigured, tested, and validated at the factory before shipment. The steps that are completed at the factory reduce the time that you spend to commission your MCC in your plant. You can then spend more time on the optimization of your IntelliCENTER MCC for your application.

The EtherNet/IP network allows for real-time monitoring and control of your intelligent devices that provides you with the ability to optimize your plant operations. The EtherNet/IP network within the IntelliCENTER EtherNet/IP MCC provides the following features:

- Single industrial network technology for plant-wide multi-discipline network convergence.
  - The EtherNet/IP network is a standard industrial Ethernet network that the ODVA organization manages.
  - Many commercially available products exist and can be attached to the EtherNet/IP network to support your application.
  - Rockwell Automation key Alliance Partners include companies like Cisco and Panduit, so the network devices you require are available over the EtherNet/IP network.
- Flexible topologies to suit your application:
  - Star
  - Linear
  - Switch-level Ring
  - Device Level Ring
- Layer 2 managed industrial Ethernet switches provide a wide range of features to make sure that your EtherNet/IP network is robust and reliable.
- Industrial Ethernet switch location and the number of EtherNet/IP ports optimized to accommodate your application
  - Pre-configured EtherNet/IP wiring and connections provide a flexible solution that is easy to maintain and use
- Rockwell Automation exclusive UL Listed 600V Rated Cat 5e copper industrial Ethernet cable provides electrical immunity
- Expandability and serviceability of the MCC to support your plant through the life of the lineup

For more information on the EtherNet/IP physical infrastructure and network topology in an IntelliCENTER MCC, see Chapter 2.

Intelligent Motor Control

The intelligent devices in an IntelliCENTER MCC are part of the Rockwell Automation IMC portfolio. These devices include variable frequency drives (VFDs), soft starters, electronic overload relays, and I/O. The intelligence in these devices lets you get the information that you need so your application runs smoothly and efficiently. Access to that intelligent information is provided by the direct connection to the EtherNet/IP network. IMC devices and features available in the IntelliCENTER EtherNet/IP MCC include the following:

- PowerFlex® 753/755 drives
  - General-purpose variable frequency drive
  - 3...5 option slots for communication, safety, feedback, and extra I/O
  - Features predictive diagnostics, and safe torque-off, and Safe Speed Monitor options
- PowerFlex 523/525 drives
  - Full featured component class drive
  - Closed loop control for either speed or position feedback
  - Features an innovative modular design and safe torque-off
- SMC™ Flex soft starters
  - Modular and compact soft starter
  - Includes I/O, electronic overload, integral bypass
- E1 Plus™ overload relays for starters
  - Includes two discrete inputs and one output relay for monitoring and control of motor starter-related I/O
  - Enhanced motor protection with overload, jam trip, and underload alarm functions
- E3 Plus™ overload relays for starters
  - Enhanced thermal overload motor protection with inherent phase loss, temperature, ground fault, voltage monitoring, and underload protection
  - Advanced motor diagnostic information to assist with preventative maintenance programs that result in reduced downtime
- E300™ overload relays for starters
  - Incorporates a modular design for communication, control, and sensing for maximum flexibility
  - On-Device Settings including network address configuration, restore factory default settings and enable security settings
  - Native I/O with removable terminal blocks
  - Advanced motor diagnostics and monitoring capabilities
- POINT I/O™ modules
  - I/O point level diagnostics and status indicators
  - Add I/O in increments of one, two, or four points

- 24V DC power
  - Integrated into the IntelliCENTER EtherNet/IP MCC.
  - Provides ease of use connections for all IMC devices that require 24V DC power.
- Automatic Device Configuration (ADC)
  - Makes the replacement of failed IMC devices simple.
  - Supported by many IMC devices.
  - Provided by Logix controllers that are paired with Stratix™ industrial managed Ethernet switches equipped with DHCP port persistence.
  - For more information, see the Automatic Device Configuration (ADC) section in Chapter 3.

For more information on a specific IMC device, see the Additional Resources table.

Intuitive Software

The IntelliCENTER software is an intuitive software package that is customized to your particular IntelliCENTER MCC configuration. The software provides a preconfigured user interface for monitoring, diagnostics, and configuration.

This user interface can be accessed at the MCC on the plant floor, in the plant control room, or from a secure remote connection. The ability to monitor remotely, diagnose, and modify intelligent device parameters keeps personnel from hazardous areas. The software has been designed to keep your MCC lineup operating well into the future. For more information on IntelliCENTER software, see IntelliCENTER Software on page 53.

IntelliCENTER EtherNet/IP MCC System Architecture

The IntelliCENTER® EtherNet/IP MCC system architecture is composed of a physical infrastructure that enables the appropriate EtherNet/IP network layout and topology for MCC applications. The physical infrastructure consists of industrial managed Ethernet switches, industrial Ethernet cable, integrated 24V DC power, and ease of use IMC device connections. The EtherNet/IP network topology provides a robust and flexible network solution. These system architecture aspects are detailed in this chapter.

Industrial Ethernet Switch

The industrial Ethernet switch is one of the most critical devices in your EtherNet/IP network because it determines the level of network security, robustness, and flexibility. There are two distinct types of industrial Ethernet switches: unmanaged and managed. Both types of switches serve a common purpose; to provide a method to connect industrial Ethernet devices to an industrial Ethernet network. The way each type of switch controls data on the network varies greatly and can have a significant impact on the performance of your industrial Ethernet network.

Why an Industrial Managed Ethernet Switch Is Critical

Industrial unmanaged Ethernet switches are designed to provide quick expansion of an industrial Ethernet network. They are typically unmodifiable or have limited configuration options, and do not provide added features that let you monitor or control how traffic is being forwarded through the switch. This option is attractive because of their lower cost and minimal configuration.

However, the potential for lost packets of data on the network is greatly increased with an industrial unmanaged Ethernet switch due to the potential for Layer 2 faults and broadcast traffic. If you avoid these types of events, you can provide a more robust and reliable network on a plant floor. Additionally, industrial unmanaged Ethernet switches do not provide the advanced security functionality that helps keep your industrial Ethernet network secure.

Industrial managed Ethernet switches are designed to give you the flexibility and features that prevent lost data due to Layer 2 faults and broadcast traffic, which is critical to network performance. With an industrial managed Ethernet switch, network segmentation, such as Virtual LANs (VLANs), and network resiliency, such as Resilient Ethernet Protocol (REP), can be implemented to make sure that network performance is maintained across a complex industrial Ethernet network.

Advanced security, network management, and diagnostics are other critical features that are provided in an industrial managed Ethernet switch. These features make sure that the expected recipient receives the information being sent over the network at the expected time while network issues are allowed to be easily resolved.

For more information on managed switch functionality, see Advanced EtherNet/IP Configuration - Industrial Ethernet Switches on page 43.

The features of an industrial managed Ethernet switch provide a robust and flexible EtherNet/IP network solution, which is why the IntelliCENTER EtherNet/IP MCC leverages an industrial managed Ethernet switch.

Industrial Ethernet Switch Details

The IntelliCENTER EtherNet/IP MCC leverages the partnership between Rockwell Automation and Cisco to implement a robust and flexible EtherNet/IP network by using the Stratix 5700™ Layer 2 industrial managed Ethernet switch. Premiere integration to the Rockwell Automation Integrated Architecture® system is provided through the Common Industrial Protocol (CIP). CIP is one of the fundamental building-blocks of the EtherNet/IP network. This protocol creates cross-functionality on many intelligent devices and products including Studio 5000 Logix Designer® Add-on Profiles (AOPs), Logix controller tags, FactoryTalk® View faceplates, and more. This cross-functionality of the Stratix 5700 switch makes sure that your IntelliCENTER EtherNet/IP MCC connects seemlessly to the EtherNet/IP network and intelligent devices in your plant.

The Stratix 5700 switch leverages embedded Cisco technology, including the Cisco Internet Operating System, or IOS, software. These common IT development tools are used to configure, monitor, and maintain the EtherNet/IP network:

- Command Line Interface (CLI) - management tool
- Cisco Network Assistant (CNA) - web interface that offers advanced options for configuring and monitoring multiple switches among other networked devices
- Device Manager - web interface to configure, monitor, and troubleshoot the switch

The Stratix 5700 switch is available in a lite software and a full software version. The default IntelliCENTER EtherNet/IP MCC configuration uses the Stratix 5700 with lite firmware, but the full firmware revision can be used if necessary. Table 1 lists the features that are included in the Stratix 5700 switch with lite firmware.

Table 1 - Features Available in the Stratix 5700 Switch With Lite Firmware

Features	Description
Switching	
REP (Resilient Ethernet Protocol)	A ring protocol that allows switches to be connected in a ring, ring segment, or nested ring segments. REP provides network resiliency across switches with a rapid-recovery time ideal for industrial automation applications.
STP/RSTP/MST (instances)	Spanning Tree Protocol is a feature that provides a resilient path between switches. Used for applications that require a fault tolerant network.
IGMP Snooping with Queries	Internet Group Management Protocol constrains the flooding of multicast traffic by dynamically configuring the switch ports. Therefore, the multicast traffic is forwarded only to ports associated with a particular IP multicast group.
VLANs with Trunking	A feature that allows you to group devices with a common set of requirements into network segments. VLANs can be used to provide scalability, security, and management to your network. Trunking lets you connect switches to expand the VLAN.
Security	
CIP port Control and fault Detection	Allows for port access based on Logix controller program or controller mode (idle/fault). Allows controlled access to the network based on machine conditions.
TACACS+, RADIUS Authentication	Terminal Access Controller Access-Control System, Remote Authentication Dial In User Service provides user authentication.
Diagnostics	
Port Mirroring	Allows for a technician to monitor the traffic on a port without interfering with the service of the network.
Syslog	System message log tool including notifications, warnings, errors, and alerts.
Broken Wire Detection	Detect cable problems like open, broken, cut, or shorted twisted-pair wires, with status availability in the Logix Designer application.
Management	
SNMP	Simple Network Management Protocol is a management protocol that is typically used by IT to help monitor and configure network-attached devices.
Smartport	Provide a set of configurations to optimize port settings for common devices like automation devices, switches, routers, personal computers, and wireless devices. Smartport can also be customized for specific needs.
DHCP Port Persistence	Lets you assign a specific IP address to each port, which makes sure that the device that is attached to a given port gets the same IP address. This feature allows for device replacement without manually having to configure IP addresses.
Command Line Interface (CLI)	Tool that lets you use text-based commands to configure a Stratix™ switch.
Compatible with Cisco Tools: CNA, CiscoWorks	Cisco tool that offers advanced options for configuring and monitoring multiple infrastructure devices, including switches, switch stacks, routers, and access points.
Application Interface	
EtherNet/IP (CIP) Interface	Interface enables premier integration to the Integrated Architecture system and Studio 5000 environment via Add-on Profiles, tags, and faceplates.

IMPORTANT For more information on Stratix 5700 functionality, see the Advanced EtherNet/IP Configuration - Industrial Ethernet Switches section.

Industrial Ethernet Switch Options

The IntelliCENTER EtherNet/IP MCC leverages different Stratix 5700 switch variations and options to fit the specific needs of your MCC. Which variation ships with your IntelliCENTER EtherNet/IP MCC depends on the type of units that are installed and which method of switch placement is chosen. The following sections explain these differences in detail.

Industrial Ethernet Switch Mounting Location

The MCC section (also known as column) can utilize two different industrial Ethernet switch mounting methodologies:

- Top or bottom horizontal wireway-mounted Stratix 5700 switches
  - One Stratix 5700 switch per section, on average
- Top or bottom unit-mounted Stratix 5700 switches
  - One or two Stratix 5700 switches per switch unit
  - A switch group is composed of all sections, and Ethernet devices within those sections that are connected to a given Stratix 5700 switch unit
  - The standard switch group can span up to 9 sections and support up to 24 intelligent device connections
  - Each MCC lineup can consist of as many switch groups as are needed to accommodate the number of Ethernet devices in the lineup

IMPORTANT You must choose one industrial Ethernet switch-mounting methodology per MCC lineup. If you choose to have your industrial Ethernet switch mounted in the horizontal wireway, all sections within that MCC lineup must have the industrial Ethernet switch mounted in the horizontal wireway.

Sections that contain plug-in or frame-mount units can use a top horizontal wireway-mounted Stratix 5700 switch. If desired, the Stratix 5700 switch can be engineered into the bottom horizontal wireway. A bottom horizontal-wireway mounting location is typically used when incoming device cable routing (for example, motor and power wires) is required in the top horizontal wireway. With this switch-mounting method, switches are placed in every section with plug-in units and most sections with 6.0 space factor frame-mount units. IMC devices within sections that contain plug-in units connect to the network through vertical wireway Ethernet adapters. Instead of using vertical wireway Ethernet adapters, IMC devices within sections that contain frame-mount units use homerun connections (direct connections from the device to switch).

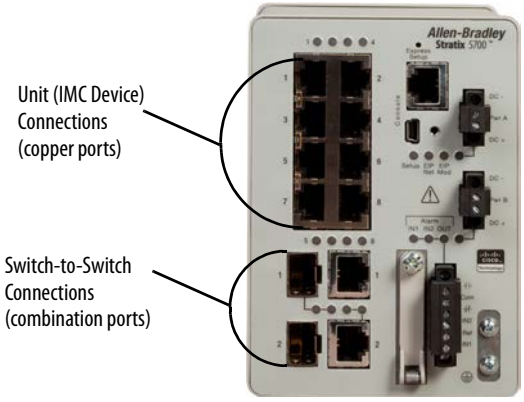
Another Stratix 5700 switch-mounting location option is in a unit. When this switch-mounting method is used, a switch is not placed in the horizontal wireway of every section. It is instead placed in a frame-mount unit within the plug-in structure. This switch unit must be located next to the top or bottom horizontal wireway. Switch units are optimized to span multiple sections. Depending on Ethernet node density within your MCC lineup, switch units can span up to nine sections. Instead of using vertical wireway Ethernet adapters, IMC devices use a homerun connection (direct connection from device to switch). All Ethernet devices within the shipping split that contains the unit-mounted switch are pre-connected at the factory to the switch (the Ethernet cable is connected at both the switch and end device). All Ethernet devices outside the shipping split that contains the unit mounted switch are pre-connected at the end device only, and the end that connects to the switch is coiled in the horizontal wireway. This coil, or industrial Ethernet cable bundle, must be connected to the appropriate switch unit in the field during commissioning of the MCC lineup.

For more information on Stratix 5700 mounting locations within the IntelliCENTER EtherNet/IP MCC, see the CENTERLINE Motor Control Center with EtherNet/IP Network Technical Data, publications 2100-TD031 and 2500-TD003.

CENTERLINE 2100 and 2500 IntelliCENTER MCC Sections/Columns with Plug-in Units and Horizontal Wireway-mounted Ethernet Switches

MCC sections with plug-in units come configured with a 10-port Stratix 5700 switch in the horizontal wireway of each section. The 10-port Stratix switch has eight copper ports and two combo copper or Small Form-factor Pluggable (SFP) ports. This set-up allocates the eight copper ports in each section for IMC device connections. The two combo copper or SFP ports are designated for the switch-to-switch connections that connect the EtherNet/IP network across MCC sections within the lineup. For information on switch-to-switch and switch-to-IMC device connections, see EtherNet/IP Network and 24V DC Connections.

Figure 1 - Stratix 5700 10-port Switch

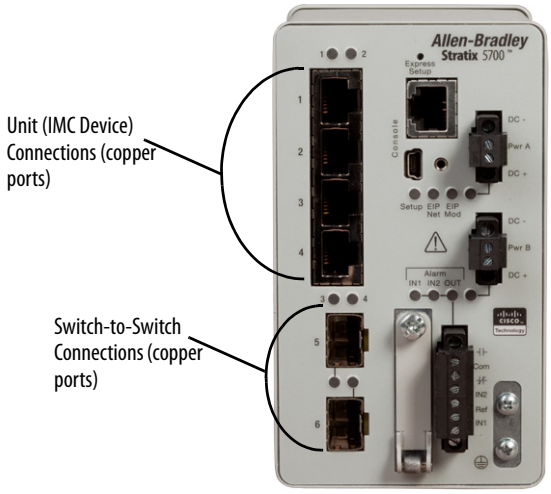


CENTERLINE 2100 and 2500 IntelliCENTER MCC Sections/Columns with Frame-mounted Units and Horizontal Wireway-mounted Ethernet Switches

MCC sections that are designed for 6.0 space factor frame-mounted units, come with a 6 port Stratix 5700 switch. This architecture is designed to support up to three adjacent MCC sections with frame-mounted units. This set-up allocates four copper ports for IMC device connections and two copper ports for the switch-to-switch connections that connect the EtherNet/IP network across MCC sections within the lineup. If there are three adjacent sections with 6.0 space factor units, the Stratix 5700 switch is mounted in the middle section. When there are only two adjacent 6.0 space factor sections, the Stratix 5700 switch is mounted in the section to the right.

For information on switch-to-switch and switch-to-IMC device connections, see EtherNet/IP Network and 24V DC Connections.

Figure 2 - Stratix 5700 6-port Switch



CENTERLINE 2100 IntelliCENTER MCC Sections with Unit-mounted Ethernet Switches

MCC sections that use a unit-mounted Stratix 5700 switch to connect to IMC devices in plug-in and frame-mounted units can come configured with 6-port, 10-port, 20-port, or 30-port (combination of 10-port and 20-port switches) switch unit options. Switch units can be 0.5 or 1.0 space factor depending on the chosen port capacity. See Table 2 for the Stratix switch types available for the IntelliCENTER EtherNet/IP MCC design that uses a unit-mounted Stratix 5700 switch.

Table 2 - Available Switch Port Capacities for Unit-mounted Stratix 5700 Switch

Space Factor	Stratix 5700 Port Capacities	Total Ethernet Port Capacity	Ethernet Device Connection Capacity	Switch-to-switch Connection Capacity
0.5 Space Factor	6-port switch	6	4	2
	10-port switch	10	8	2
1.0 Space Factor	6-port switch	6	4	2
	10-port switch	10	8	2
	20-port switch	20(1)	16	2
	Combination 10-port and 20-port switches	30(1)	24	2

(1) The 20-port switch includes two dedicated SFP ports that are not used in the standard IntelliCENTER MCC design.

Industrial Ethernet Cable

Due to the high potential of electrical interference in an MCC, the proper industrial Ethernet communication cable is critical to provide a reliable and robust EtherNet/IP network. The EtherNet/IP network can technically use the same copper Ethernet cable that is used in an enterprise Ethernet network. But, to use that same enterprise rated Ethernet cable in an MCC is not a reliable and robust solution. Due to the potential of 600V AC-related electrical noise in the MCC, the enterprise Ethernet rated cable can be exposed to electrical noise greater than its rated immunity. The IntelliCENTER EtherNet/IP MCC uses an exclusive 600V, UL Listed, Category 5e, PLTC rated industrial Ethernet cable to provide the noise immunity necessary in an MCC.

With this 600V UL Listed industrial Ethernet cable, the EtherNet/IP network in the IntelliCENTER MCCs has been tested to the most rigorous standards for electrical noise immunity. These test results allow Rockwell Automation to deliver a robust, noise-immune EtherNet/IP network within the MCC:

- Surge - Simulates lightening strike
  - ± 2KV, 40A surge that is repeatedly applied to the network cable
  - IEC 61000-4-5
- Fast Transient Burst - Simulates industrial noise
  - ± 1KV high voltage burst applied to the network cable
  - IEC 61000-4-4
- Conducted Immunity - Simulates radio frequency interference
  - 150 kHz...80 MHz interference that is applied to the network cable
  - IEC 61000-4-6
- Electrostatic Discharge Immunity - Simulates static discharge
  - ± 8KV ESD event at 12 locations on the MCC and network cable
  - IEC 61000-4-2

Figure 3 - Industrial Ethernet Network Cable

Table 3 shows the three speeds that the Category 5e cable supports. The higher speed data rates allow more data to be transferred in a shorter period, which can be vital for applications that require short response times.

Table 3 - Category 5e Copper Cabling

Speed Rating	Data Speed
10BASE-T	10 Mb/s
100BASE-TX	100 Mb/s
1000BASE-T	1 Gb/s

The standard industrial Ethernet cable for all switch-to-IMC device connections within the IntelliCENTER EtherNet/IP MCC is the 600V UL Listed copper Ethernet cable. However, fiber-optic Ethernet cable is sometimes required for switch-to-switch EtherNet/IP connections in certain EtherNet/IP topologies. See the Resilient Ethernet Protocol (REP) section for more information on when fiber-optic Ethernet cable can be required within an IntelliCENTER EtherNet/IP MCC.

The 600V UL Listed industrial Ethernet cable is also commonly used to connect the IntelliCENTER EtherNet/IP MCC to the plant EtherNet/IP network. For more information on the use of the 600V, UL Listed cable outside of the MCC, see the MCC Uplink Industrial Ethernet Cable in Chapter 3.

24V DC Power

24V DC power is integrated throughout the IntelliCENTER EtherNet/IP MCC and is supplied by 24V DC power supplies that reside in plug-in MCC units. Optional redundant 24V DC power supply configurations are also available. The integrated 24V DC power provides ease of use connections for all IMC devices with EtherNet/IP communication options that require 24V DC power and the Stratix 5700 switches. For information on the 24V DC power connections, see EtherNet/IP Network and 24V DC Connections.

The number of 24V DC power supplies required throughout the IntelliCENTER EtherNet/IP MCC is dependant upon the number of Ethernet switches and IMC EtherNet/IP communication devices that require 24V DC power. For more information on the 24V DC power configuration and layout, see the CENTERLINE Motor Control Center with EtherNet/IP Network Technical Data, publications 2100-TD031 and 2500-TD003.

EtherNet/IP Network and 24V DC Connections

The IntelliCENTER EtherNet/IP MCC design uses the best practices from the IntelliCENTER DeviceNet MCC design but adds the flexibility and performance of an EtherNet/IP network. These design methods deliver a fast and reliable industrial network for the IntelliCENTER EtherNet/IP MCC.

EtherNet/IP Network and 24V DC Connections within a Shipping Split

CENTERLINE IntelliCENTER MCCs ship configured from the factory in shipping splits that typically consist of one, two, or three MCC sections. Because the shipping split ships as a continuous block of MCC sections, all EtherNet/IP and 24V DC power connections for IMC devices within the shipping split are prewired at the factory. The connections include all Ethernet switch-to-IMC device connections and all 24V DC power connections for IMC devices. Additionally, Ethernet switch-to-switch connections within an MCC shipping split are also prewired at the factory. For information on connections across MCC shipping splits that are not prewired at the factory, see the EtherNet/IP Network and 24V DC Connections Across Shipping Splits section.

The MCC section type and switch mounting methodology determines how these prewired connections are made and routed at the factory.

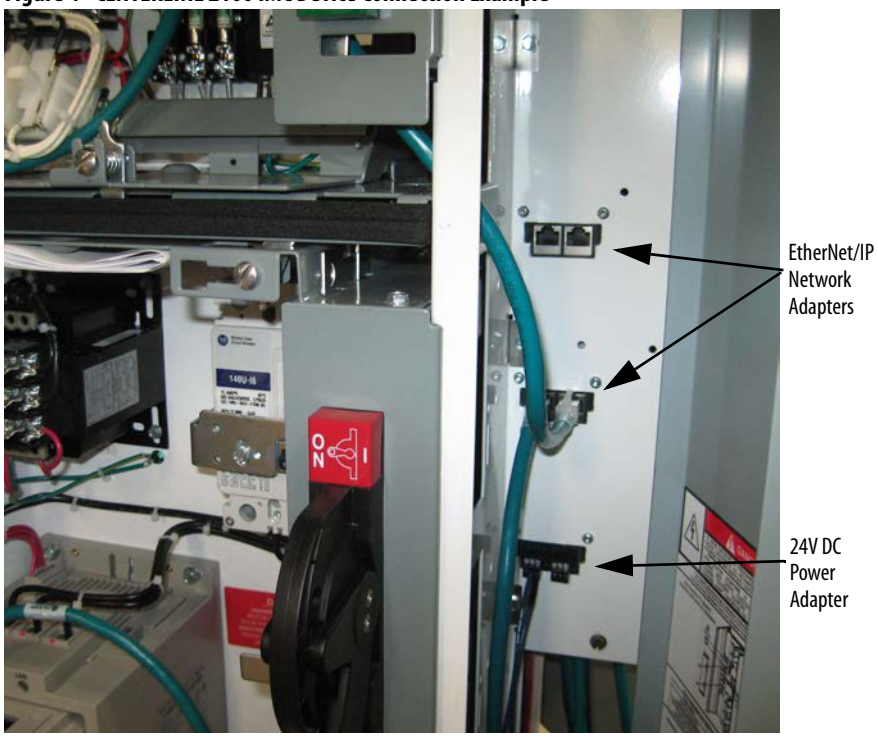
- MCC sections/columns with plug-in units and horizontal wireway-mounted Ethernet switches use two types of vertical wireway adapters for these IMC device connections:
  - EtherNet/IP network adapters and 24V DC power adapters.
  - These adapters save valuable wireway space, provide ease of use connectivity, and allow for quick maintenance when devices are moved, replaced, or added.
  - The CENTERLINE® 2100 and 2500 vary slightly on the wireway adapter mechanism because the NEMA specifications and market demands are different than IEC specifications and market demands.
- MCC sections/columns with unit-mounted Ethernet switches use direct (homerun) Ethernet connections and 24V DC power adapters for IMC device connections.
- MCC sections/columns with frame-mounted units use direct (homerun) Ethernet and 24V DC power connections for IMC devices because they typically do not contain vertical wireways or wireway adapters.

CENTERLINE 2100 IntelliCENTER MCC Sections with Plug-in Units and Horizontal Wireway-mounted Ethernet Switches

For the NEMA rated CETNERLINE 2100 IntelliCENTER MCC, EtherNet/IP network adapters and 24V DC power adapters are mounted in the vertical wireways in each section that contains plug-in units. There are four, two-port EtherNet/IP network adapters in each MCC section. Each EtherNet/IP adapter is connected to the Stratix 5700 switch in that section and can be easily connected to an IMC device. There are four 24V DC power adapters in each MCC section. Each 24V DC power adapter is connected to the integrated 24V DC power supply and can be easily connected to an IMC device. Any EtherNet/IP or 24V DC power connection that an IMC device in a plug-in unit requires, is connected at the factory by using these adapters.

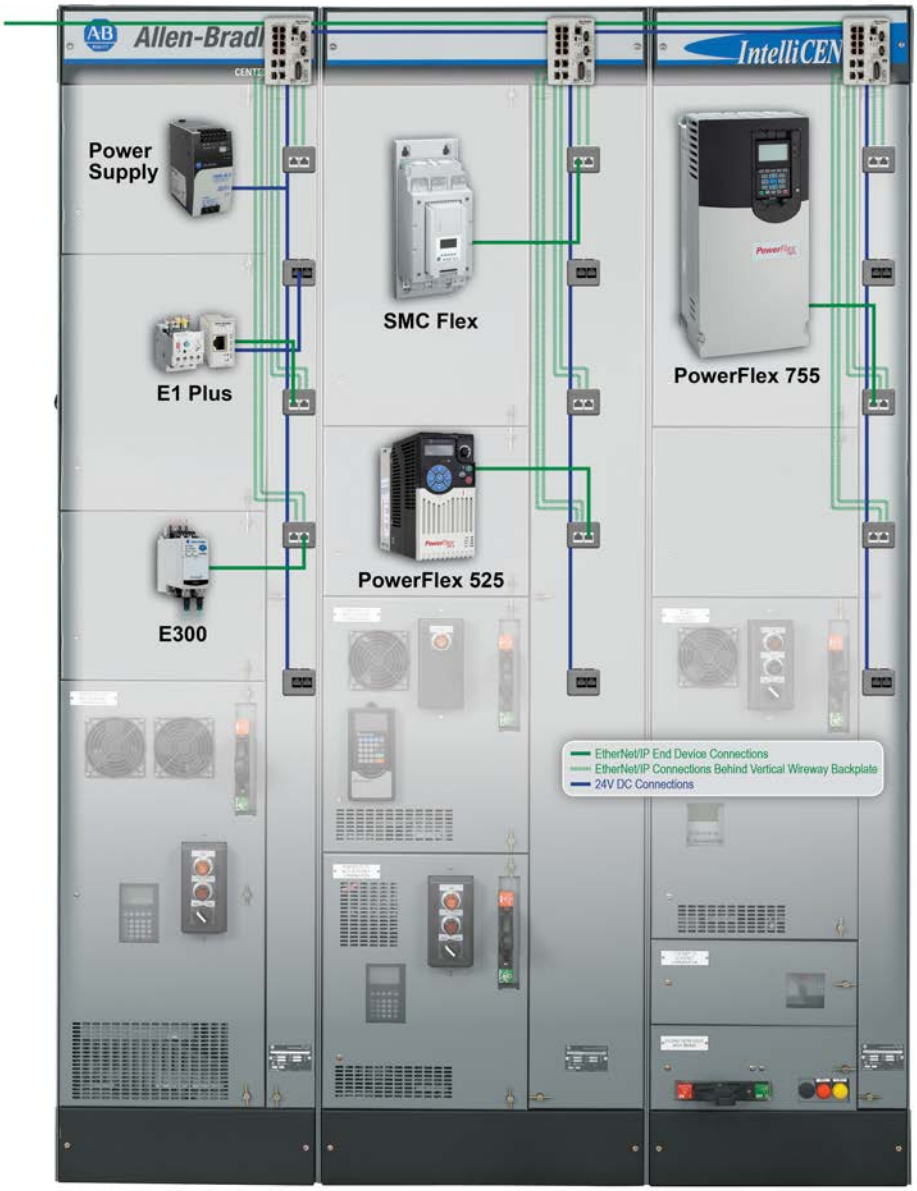
Figure 4 shows how the adapters are mounted in the MCC.

Figure 4 - CENTERLINE 2100 IMC Device Connection Example



One shipping split of the CENTERLINE 2100 IntelliCENTER EtherNet/IP MCC with cable routings and IMC device adapters can be seen in Figure 5.

Figure 5 - CENTERLINE 2100 IMC Device Wiring - Horizontal Wireway-mounted Ethernet Switch



IMPORTANT Not all IMC device vertical wireway adapters are shown in the graphic.

For more information on EtherNet/IP network connections and 24V DC connections within sections that contain plug-in units, see the CENTERLINE 2100 Motor Control Center with EtherNet/IP Network Technical Data, publication 2100-TD031.

CENTERLINE 2100 IntelliCENTER MCC with Unit-mounted Ethernet Switches

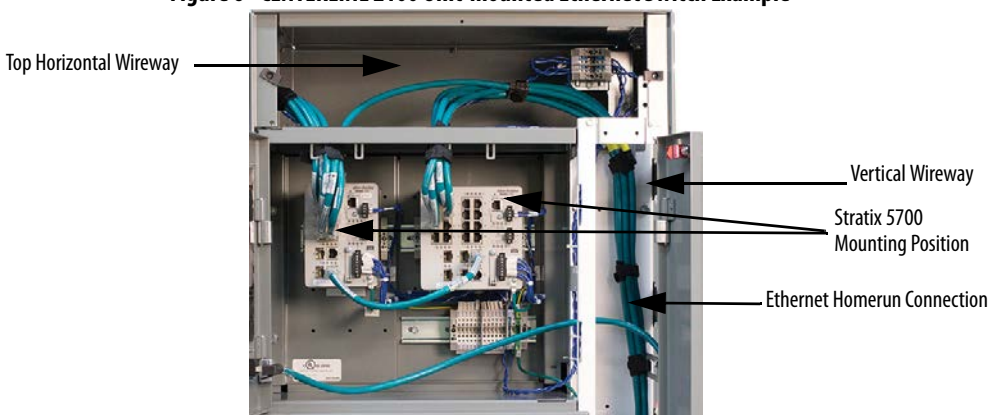
The IntelliCENTER EtherNet/IP design with unit-mounted Stratix 5700 switches uses vertical wireway 24V DC power adapters to connect IMC devices in plug-in units to the integrated 24V DC power supply. This design also uses direct Ethernet connections (homerun connections) to connect IMC devices to the Stratix 5700 switch. Each section belongs to a specific switch group, and each switch group has one or two Stratix 5700 switches that are located in a switch unit. (6-port, 10-port, 20-port, or 30-port switch unit options are available.)

- Two vertical-wireway 24V DC power adapters in all plug-in sections.
- The Stratix switch unit connects to the IMC devices in its switch group. A switch group can span 1...9 sections.
- Ethernet devices within the shipping split that contains the unit mounted switch are pre-connected to the switch at the factory (the Ethernet cable is connected at both the switch and end device).
- All Ethernet devices outside the shipping split that contains the unit mounted switch are pre-connected at the end device only and the end that connects to the switch is coiled in the horizontal wireway. This coil, or industrial Ethernet cable bundle, must be connected to the appropriate switch unit in the field during commissioning of the MCC lineup.
- An industrial Ethernet cable label is added to both sides of each cable to help ensure proper IMC device-to-switch port mapping and switch-to-switch port mapping.
- An Ethernet network table that contains detailed switch and IMC device information is added to the one-line diagram of each MCC lineup to help you commission your MCC.

  For more information on cable labels and the network table, see the CENTERLINE 2100 Motor Control Center with IntelliCENTER Technology Using an EtherNet/IP Network, publication 2100-TD031.

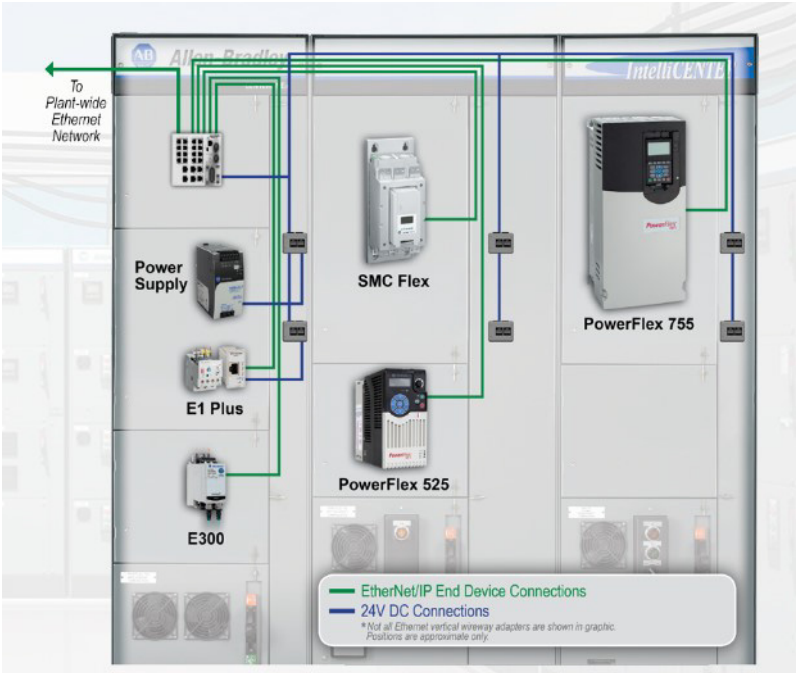
Figure 6 shows how the Ethernet switches are mounted in the MCC.

Figure 6 - CENTERLINE 2100 Unit-mounted Ethernet Switch Example



One shipping split of the CENTERLINE 2100 IntelliCENTER EtherNet/IP MCC with cable routings and IMC device connections can be seen in Figure 7.

Figure 7 - CENTERLINE 2100 IMC Device Wiring - Unit-mounted Ethernet Switch



CENTERLINE 2500 IntelliCENTER MCC Columns with Plug-in Units

For the IEC rated CENTERLINE 2500 IntelliCENTER MCC, each plug-in unit incorporates an automatic mounting for one EtherNet/IP adapter and one 24V DC power adapter. The mechanism automatically makes the EtherNet/IP network and 24V DC power connections when the unit is inserted into the column. Each unit provides one EtherNet/IP connection to the Stratix 5700 in that column and one 24V DC power connection to the integrated 24V DC power supply. Because the plug-in units are installed at the factory, these automatic connections are also made at the factory. All EtherNet/IP network and 24V DC power connections from the IMC devices to the plug-in unit remain intact during unit removal.

Figure 8 - CENTERLINE 2500 Front View - IMC Device Connection Example

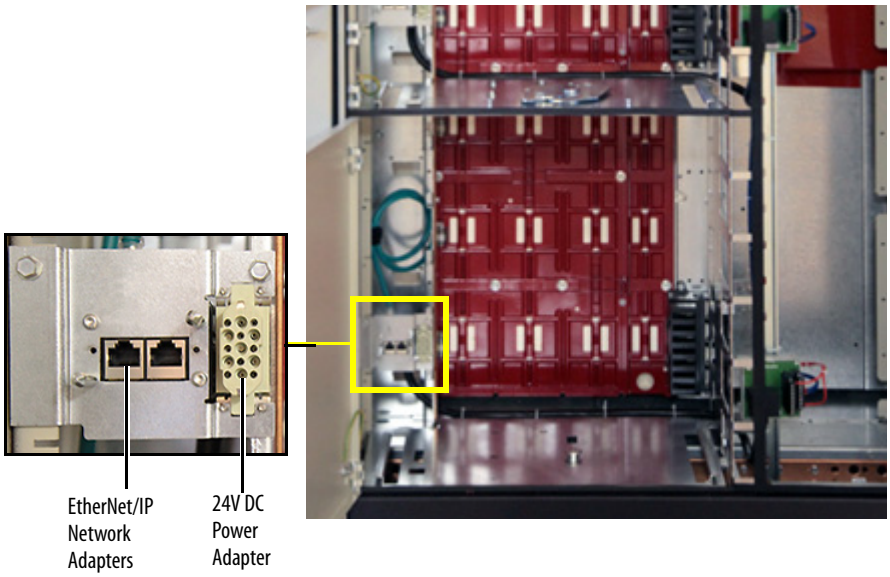


Figure 9 - CENTERLINE 2500 Top View - IMC Device Connection Example

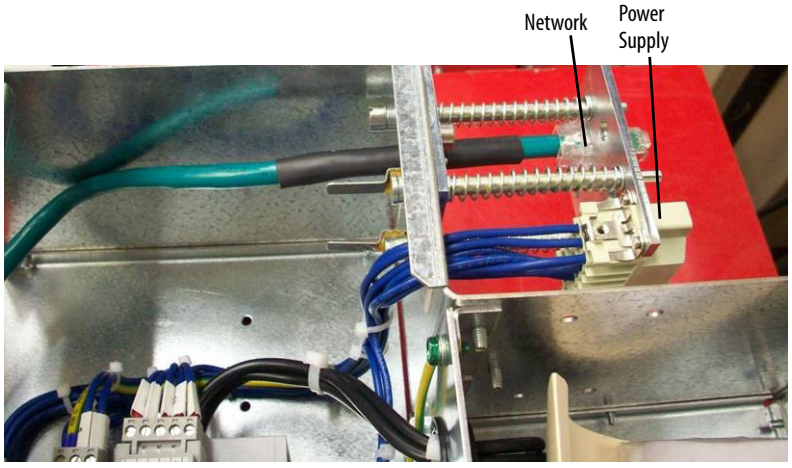
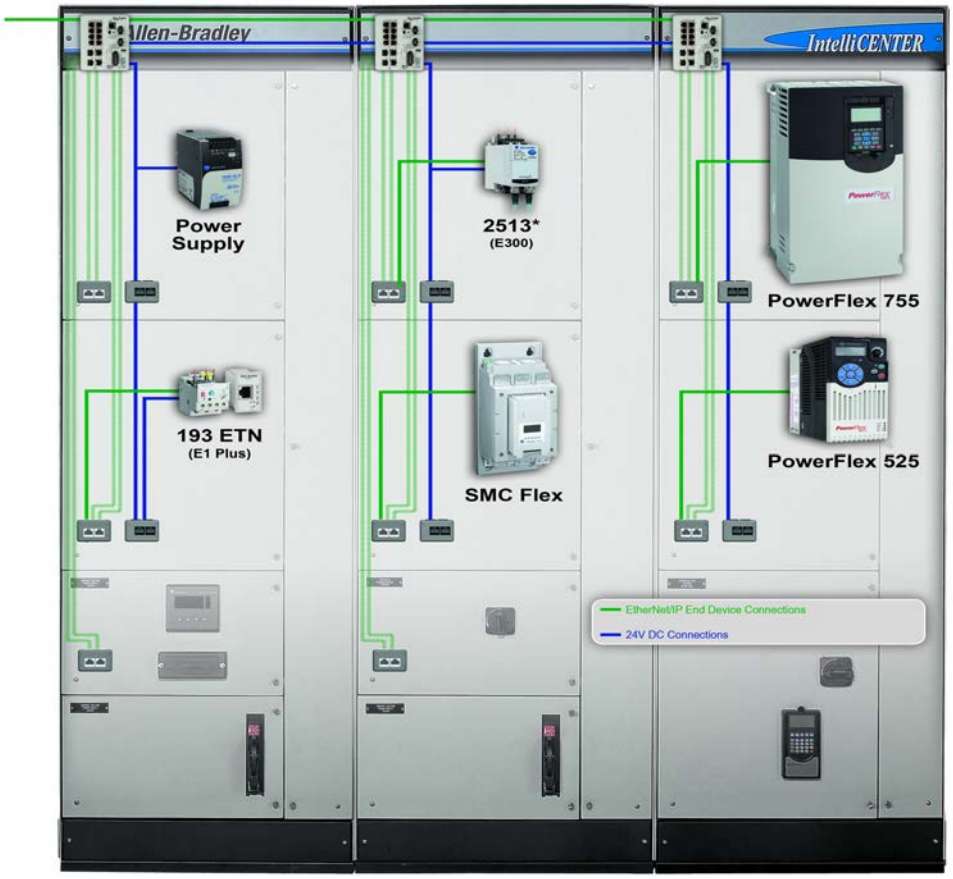


Figure 10 - CENTERLINE 2500 IMC Device Wiring



IMPORTANT Not all IMC device vertical wireway adapters are shown in the graphic.

For more information on EtherNet/IP network connections and 24V DC connections within columns that contain plug-in units, see the CENTERLINE 2500 Motor Control Center with EtherNet/IP Network Technical Data, publication 2500-TD003.

CENTERLINE 2100 and 2500 IntelliCENTER MCC Sections/Columns with Frame-mounted Units

CENTERLINE 2100 and 2500 sections/columns that contain frame-mounted units use direct (homerun) IMC device connections because they do not contain vertical wireways or wireway adapters. The EtherNet/IP and 24V DC power connections are prewired from the IMC devices to the Stratix 5700 switch and 24V DC power supply at the factory.

EtherNet/IP Network and 24V DC Connections Across Shipping Splits

CENTERLINE IntelliCENTER MCCs ship configured from the factory in shipping splits that typically consist of one, two, or three MCC sections. Because the shipping split ships as a continuous block of MCC sections, all EtherNet/IP and 24V DC power connections for IMC devices within the shipping split are prewired at the factory. The connections includes all EtherNet/IP switch-to-IMC device connections and all 24V DC power connections for IMC devices. Additionally, EtherNet/IP switch-to-switch connections within an MCC shipping split are also prewired at the factory.

For horizontal wireway-mounted Ethernet switches: The standard IntelliCENTER EtherNet/IP MCC design includes an industrial Ethernet patch cable and a 24V DC cable. The cables are in the horizontal wireway of the last section (right-most section) of a shipping split, for mating with the first section of the next shipping split.

For unit-mounted Ethernet switches: All Ethernet devices outside the shipping split that contains the unit-mounted switch are pre-connected at the end device only. The end that connects to the switch is coiled in the horizontal wireway. This coil, or industrial Ethernet cable bundle, must be connected to the appropriate switch unit in the field during the commissioning of the MCC lineup. A teal label on the outside of the MCC horizontal wireway cover indicates the location of each coil that requires connection during the commissioning process. Each cable in the bundle contains a detailed cable label to help ensure proper IMC device-to-switch port mapping.

For more information on EtherNet/IP network and 24V DC connections across shipping splits, see the CENTERLINE Motor Control Center with EtherNet/IP Network Technical Data, publications 2100-TD0031 and 2500-TD003.

IMPORTANT	If your MCC lineup includes unit-mounted Ethernet switches with switch groups that do not span shipping splits, all Ethernet devices are pre-connected at the factory to each switch unit (the Ethernet cable is connected at both the switch and end device).

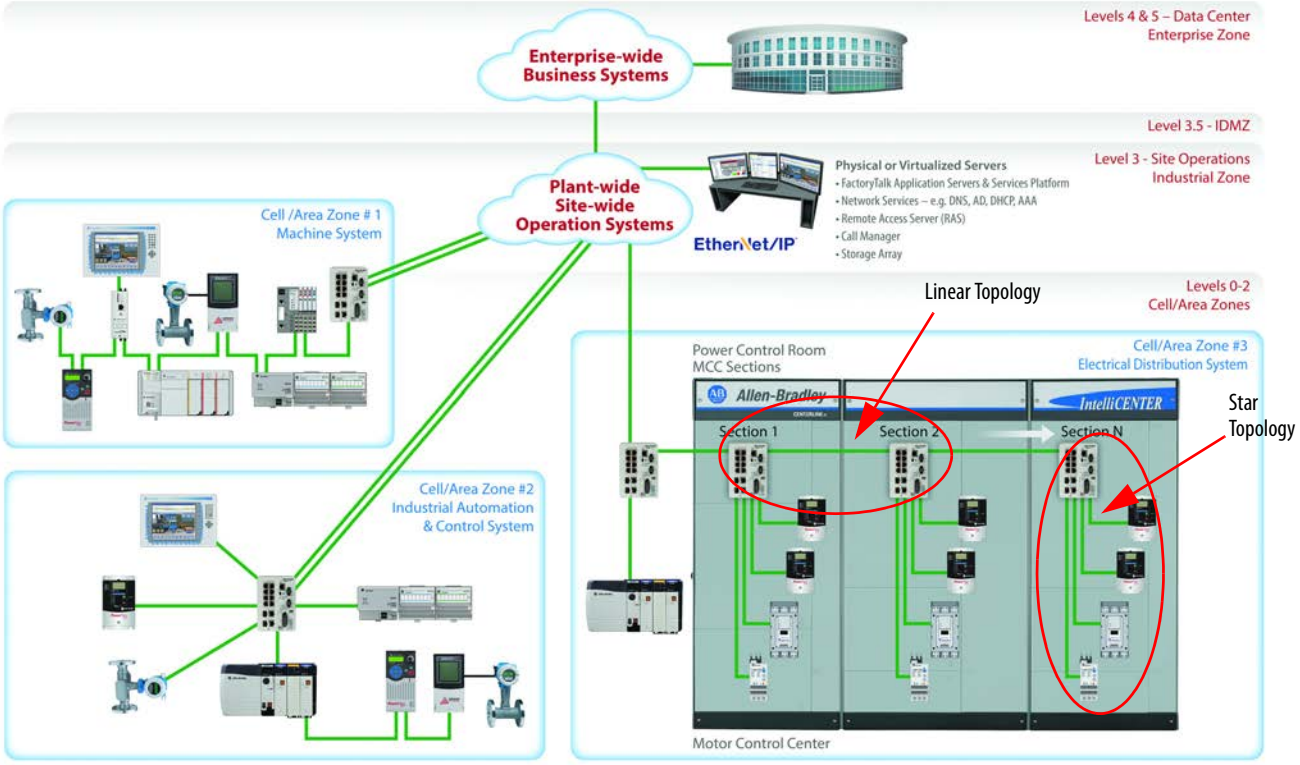
EtherNet/IP Network Topology

The EtherNet/IP network is a flexible network that supports multiple topologies (Star, Linear, Switch-level Ring, and Device Level Ring). The EtherNet/IP network topology within an IntelliCENTER EtherNet/IP MCC must provide a robust and flexible network solution. Therefore, a star topology is typically used at the IMC device level and either a linear or ring topology is typically used at the industrial Ethernet switch level. These topology combinations provide customers with the ideal EtherNet/IP network solution for their MCC application.

Linear/Star Topology

The typical EtherNet/IP network topology that is used in the IntelliCENTER EtherNet/IP MCC is a linear/star topology. The industrial Ethernet switches throughout the MCC lineup are connected in a linear topology via their linear trunk (switch-to-switch) connections. The IMC devices in each section use a star topology to connect to the industrial Ethernet switch level.

Figure 11 - Linear/Star MCC Topology in a Typical Plant-wide Network



The linear/star topology within an IntelliCENTER EtherNet/IP MCC provides the following:

- An easily expandable network architecture
  - Star topology allows IMC devices to be easily added to existing MCC sections within an MCC lineup
  - Switch-level linear topology allows MCC sections to be easily added to the MCC lineup
- A flexible, maintainable, and serviceable network architecture
  - Star topology allows IMC devices to be easily moved or removed, as MCC maintenance and lineup changes demand, without impacting the remaining IMC devices
  - Switch-level linear topology allows MCC sections to be easily moved or removed, as MCC maintenance and lineup changes demand, without impacting the remainder of the MCC lineup
  - ADC, a feature that is supported in Logix controllers (PACs), helps minimize downtime by automatically configuring a replacement IMC device in the event of a device failure. For more information, see the Automatic Device Configuration (ADC) section in Chapter 3

See Chapter 4 for information on how you can expand your MCC lineup.

The linear/start topology that is used in an IntelliCENTER EtherNet/IP MCC allows it to be seamlessly integrated into the rest of the plant. See the Plant EtherNet/IP Connection section in Chapter 3 for more information on plant integration.

Switch-level Ring/Star Topology

An increased focus in the MCC market space is the demand for the IMC devices within the integrated network to provide a level of high availability. By definition, high availability is the time that a network or device is fully functioning. Typically, this time includes the ability of a network to ride through a physical device failure or cable break. For MCC applications, high availability also includes downtime that is associated with hardware or software misconfiguration of the integrated network or IMC devices. For an MCC solution to be truly considered highly available, it must provide the appropriate level of network resiliency, and be easy to configure and maintain both physically and via software. Network resiliency cannot be provided at the cost of losing IMC device serviceability or intuitive network and device configuration.

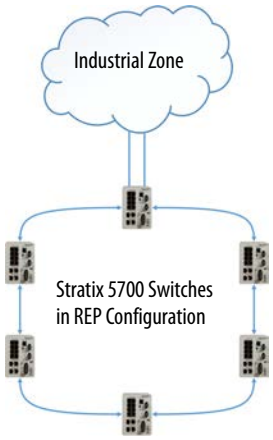
The IntelliCENTER EtherNet/IP MCC is designed to provide ease of use, network resiliency, and serviceability to achieve the desired level of high availability. To build on the typical linear/star topology of an IntelliCENTER EtherNet/IP MCC, the industrial Ethernet switches throughout the MCC lineup can also be connected in a switch-level ring topology. The Resilient Ethernet Protocol (REP), a protocol that is provided by Stratix managed switches, provides a level of resiliency at the switch level, while the IMC devices in each section still maintain a star topology.

This switch-level ring/star topology provides the same advantages that are described in the Linear/Star Topology section, but adds switch-level resiliency. This combination provides the appropriate balance of ease of use, resiliency, and serviceability that is required for high availability within MCC applications.

Resilient Ethernet Protocol (REP)

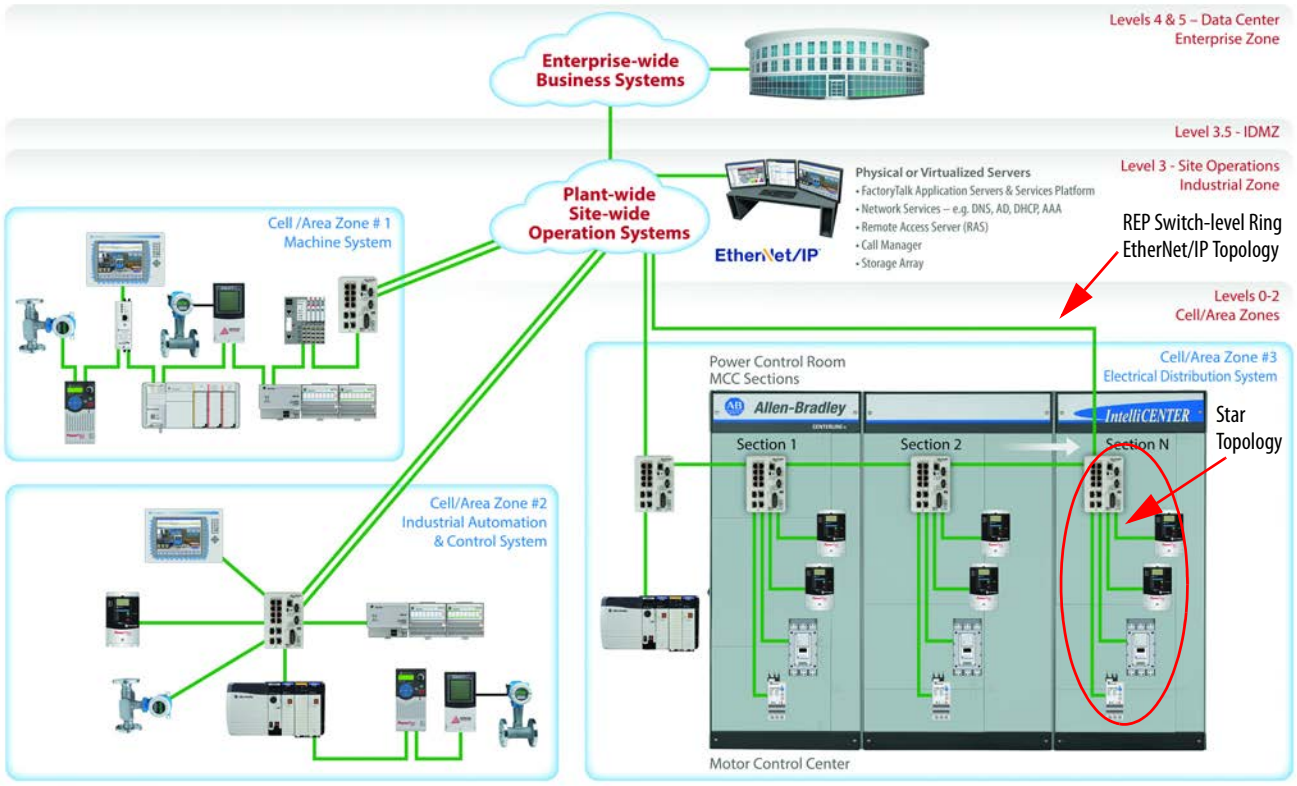
In an IntelliCENTER EtherNet/IP MCC, the Stratix 5700 industrial Ethernet switch uses the Resilient Ethernet Protocol, or REP, to provide the switch-level ring redundant path topology. Figure 12 shows an example of a switch-level ring topology that uses REP.

Figure 12 - REP Network Example



The implementation of the switch-level ring topology within an IntelliCENTER EtherNet/IP MCC is similar to the linear/star topology example in Figure 11. But the switch-level ring topology adds a ring industrial Ethernet cable that connects the last MCC section back to the plant-wide network. If one industrial Ethernet cable or industrial Ethernet switch fails, communication is converged in the other direction around the ring to make sure that all other switches are still connected to the network. The convergence of communication provides single fault tolerance at the switch level. The switch-level ring topology is highlighted in Figure 13.

Figure 13 - Switch-level Ring/Star MCC Topology with REP in a Typical Plant-wide Network



REP is a Cisco Layer 2 resiliency protocol that provides an alternative to the Spanning Tree Protocol (STP) to control network loops, handle link failures, and improve convergence time significantly. REP does not require extra hardware; it is enabled in the Stratix 5700 switch configuration software to provide the added resiliency via a switch-level ring redundant path topology. REP also provides an extra layer of security by producing a security key that is unique to each REP ring segment. This security key makes sure that security threats cannot inflict false network faults that could bring down network communication.

The REP guidelines in the Resilient Ethernet Protocol in a Converged Plantwide Ethernet System (CPwE) design guide, publication ENET-TD005, recommend the use of fiber media and Small Form-factor Pluggable (SFP) modules for all switch-to-switch connections, specifically 1 Gbps fiber connections, to provide optimum convergence in REP topologies. These guidelines are based on the testing and validation of REP by Cisco and Rockwell Automation, with the Allen-Bradley controllers (PACs) configured with the default requested packet interval (RPI) value of 20 ms for standard I/O.

In many MCC-based applications, device and I/O RPI settings as fast as the default 20 ms are not required. For applications that can perform appropriately with device and I/O RPI settings of 100 ms or greater, a Fast Ethernet (100 Mbps) copper switch-to-switch connection can provide sufficient convergence in a REP topology. Table 4 shows what types of industrial Ethernet cables for switch-to-switch connections can be used in combination with what device and I/O RPI criteria to provide optimum REP convergence.

Table 4 - REP Industrial Ethernet Cable Options

Type of Industrial Ethernet Cables for Switch-to-Switch Connections	Device and I/O RPI Criteria for Optimum REP Convergence
Fast Ethernet (100 Mbps) Copper Industrial Ethernet cable(1)	Device and I/O RPI ≥ 100 ms
Gigabit Ethernet (1 Gbps) Fiber-optic Ethernet cable(2)	Device and I/O RPI ≥ 20 ms

(1) Standard IntelliCENTER EtherNet/IP MCC 600V, UL Listed, copper industrial Ethernet cable is used for this application, see Industrial Ethernet Cable for information about the cable.

(2) See Fiber Optic Infrastructure Application Guide, publication ENET-TD003 for more information about fiber-optic Ethernet cable.

IMPORTANT If REP is implemented using 100 Mbps Copper industrial Ethernet cable, the Device and I/O RPI settings must be changed to be ≥ 100 ms to achieve optimum REP convergence.

IMPORTANT The REP industrial Ethernet Cable guidelines that are outlined in this section require that the MCC Uplink requirements are followed. Not adhering to the MCC Uplink requirements could negatively impact the REP EtherNet/IP network performance. For more information on MCC Uplink guidelines, see the MCC Uplink to Plant-wide Network section in Chapter 3.

IMPORTANT When deploying a switch-level ring/star topology that uses REP within your IntelliCENTER EtherNet/IP MCC, the switch-to-IMC device connection remains the standard 600V, UL Listed copper industrial Ethernet cable. See Table 4 for switch-to-switch connection guidelines.

For more information on REP and how to implement a REP topology in a plant-wide EtherNet/IP system, refer to the Resilient Ethernet Protocol in a Converged Plantwide Ethernet System (CPwE) technical data, publication ENET-TD005.

The Switch-level Ring/Star topology that is used in an IntelliCENTER EtherNet/IP MCC allows it to be seamlessly integrated into the rest of the plant-wide network. See the Plant EtherNet/IP Connection section in Chapter 3 for more information on plant integration.

Other Topologies

As previously mentioned, the EtherNet/IP network is a flexible network that supports multiple topologies. Along with the Linear/Star Topology and Switch-level Ring/Star Topology, there are other EtherNet/IP network topologies that provide useful functionality in a plant-wide network. One of those topologies is Device Level Ring (DLR), which is another network resiliency option. Similar to REP (see Resilient Ethernet Protocol (REP)), DLR provides network resiliency via a ring topology. The key difference however, is that DLR provides network resiliency at the IMC device level whereas, REP provides network resiliency at the switch level. Because DLR fault tolerance is at the IMC device level, customers typically do not service (add, replace, move) IMC devices in DLR topologies while the machine is running or under power. Thus, DLR is often used at the machine-level where the IMC devices and industrial Ethernet cables are mounted closer to the machine itself, typically in an electrical panel and not an MCC. DLR design requirements, including device count limits and dual port supported devices, must also be followed.

While DLR does provide fault tolerance at the IMC device level, it also impacts the flexibility and maintainability of IMC devices within an MCC solution whereas switch-level ring/star (REP) does not. As described in the Switch-level Ring/Star Topology section, REP provides fault tolerance at the switch level and the IMC device star topology makes sure that IMC device failures do not affect other IMC devices. The level of fault tolerance that is provided is similar to DLR. Therefore, the switch-level ring/star topology provides a more highly available MCC solution and is the preferred redundant path topology within an IntelliCENTER EtherNet/IP MCC.

Notes:

IntelliCENTER EtherNet/IP MCC Plant Integration

As detailed in Chapter 2, the IntelliCENTER® EtherNet/IP MCC system architecture (the EtherNet/IP physical infrastructure and EtherNet/IP network topology) provides an easy to use, robust, and flexible network solution. This chapter explains how to integrate the IntelliCENTER EtherNet/IP MCC into an existing plant-wide and/or enterprise network. Physical-integration aspects including industrial Ethernet cables for plant EtherNet/IP uplink connections, and industrial Ethernet switch and IMC device configuration are covered in detail. IntelliCENTER software, which provides an intuitive, preconfigured user interface for MCC monitoring, diagnostics, and configuration is also covered.

Plant EtherNet/IP Connection

As discussed in the EtherNet/IP Network Topology section in Chapter 2, the IntelliCENTER EtherNet/IP MCC typically uses a star topology at the IMC device level and either a linear or ring topology at the industrial Ethernet switch level. The flexibility of the EtherNet/IP network allows these IntelliCENTER EtherNet/IP MCC topology configurations to be easily integrated into a larger, properly designed plant-wide network without interfering with other EtherNet/IP network topologies in the plant. To make sure your IntelliCENTER EtherNet/IP MCC is properly integrated into your plant-wide network, it is critical to connect it appropriately and to choose the right industrial Ethernet cable.

Plant Layers and Zones

As discussed in the Converged Plantwide Ethernet (CPwE) Design and Implementation Guide, publication ENET-TD001, the ideal network-reference model consists of three main layers: the core, distribution, and access. The IntelliCENTER EtherNet/IP MCC is integrated into a plant-wide network by using this model. An example of how an IntelliCENTER EtherNet/IP MCC connects into a plant-wide EtherNet/IP network is shown in Figure 14.

The Core Layer usually comprises of Layer 3 Ethernet switches or routers and bridges and provides connectivity to the Industrial Demilitarized Zone (IDMZ) as shown in Figure 14. The IDMZ is a buffer between the Enterprise and Industrial zones that provides a barrier between the zones, but allows for data and services to be shared securely. These switches and routers allow valuable information from the plant floor (efficiency, energy usage, plant production output) to be securely shared with the Enterprise business network via the IDMZ. The IDMZ keeps basic enterprise traffic, such as email or internet usage, from causing interference with the plant-floor EtherNet/IP network.

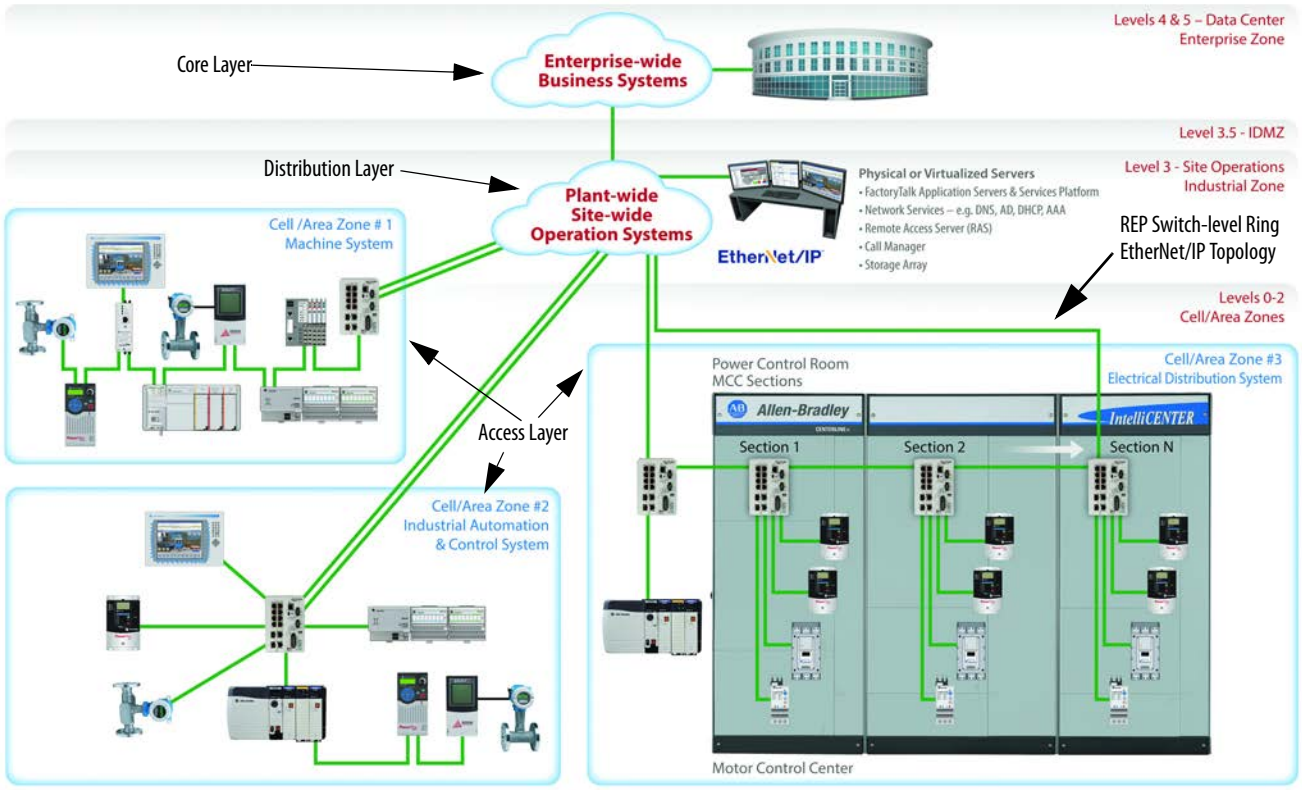
Plant-wide networks that interconnect all devices and operations on the plant floor constitute the Distribution Layer. Layer 3 Ethernet switches or routers, Historian servers, and View servers typically constitute the infrastructure in the Distribution Layer. Because this layer is the foundation of the EtherNet/IP network in a facility or plant, network resiliency is often desired. As described in the EtherNet/IP Network Topology section in Chapter 2, the IntelliCENTER EtherNet/IP MCC supports a switch-level ring/star topology, which provides a redundant path topology connection to the Distribution Layer. An example of network resiliency in the Distribution Layer is shown in Figure 14 by the two industrial Ethernet cables from Zone 1, 2, and 3 to the plant-wide system.

The Access Layer is typically broken into zones that are made up of plant-floor cells or areas. These zones are commonly segregated from the rest of the EtherNet/IP network with a Layer 2 industrial Ethernet switch. The Layer 2 switch in each zone contains the necessary functionality to manage network traffic and provide some network security, which maintains the integrity of the plant-wide network. Each zone uses the appropriate EtherNet/IP network topology to connect its devices to the rest of the plant-wide network. Each zone has its own critical function and unique requirements (access, security, control, network resiliency). However, all zones can communicate with each other over the EtherNet/IP network, if desired.

To emphasize the flexibility of an EtherNet/IP network, Zone 1, in Figure 14, connects EtherNet/IP devices in a linear or daisy chain topology. Zone 2 uses a star or home-run topology to connect each of the EtherNet/IP devices. Each topology provides different benefits that are based on the needs of the particular zone. The linear topology in Zone 1 minimizes the amount of industrial Ethernet cable runs, but does not provide any network resiliency. If there is a cable or device failure with any device, all devices downstream are disconnected. The benefit of Zone 2 is that all EtherNet/IP devices that are connected via the star topology are not disconnected if there is an issue with one device. However, a star topology requires more network cable runs, which typically requires more industrial Ethernet cabling.

As shown in Zone 3 in Figure 14, the IntelliCENTER EtherNet/IP MCC easily integrates into the Access Layer of the plant-wide EtherNet/IP network. The MCC Uplink to Plant-wide Network section provides guidelines on how the IntelliCENTER EtherNet/IP MCC network connects to the plant-wide network. The CPwE Design and Implementation Guide network-reference model helps make sure that device information in the Access Layer can be securely and reliably provided to the Distribution and Core Layers as needed. For more information on how to lay out the appropriate plant-wide EtherNet/IP network, see the CPwE Design and Implementation Guide, publication ENET-TD001,

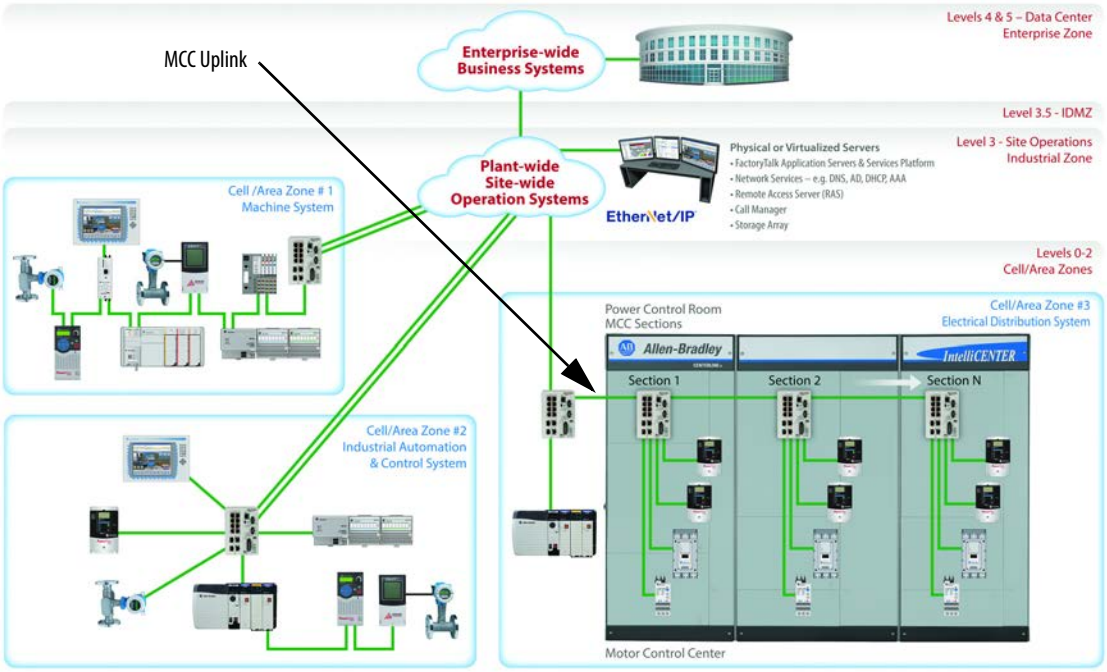
Figure 14 - Example Plant-wide EtherNet/IP Network



MCC Uplink to Plant-wide Network

Figure 15 shows an example of how the IntelliCENTER EtherNet/IP MCC can be connected to an Access Layer switch with an industrial Ethernet cable, which then provides the connection to the entire plant-wide EtherNet/IP network. This connection is commonly referred to as an MCC uplink and can be used for intelligent device monitoring and/or control depending on the needs of the MCC application. As described in the EtherNet/IP Network Topology section in Chapter 2, the IntelliCENTER EtherNet/IP MCC also supports an optional switch-level ring topology. This topology requires a second MCC uplink to close the switch-level ring.

Figure 15 - Plant-wide Connection


MCC Uplink
Enterprise-wide Business Systems
Levels 4 & 5 – Data Center Enterprise Zone
Level 3.5 - IDMZ
Plant-wide Site-wide Operation Systems
Physical or Virtualized Servers
• FactoryTalk Application Servers & Services Platform
• Network Services – e.g. DNS, AD, DHCP, AAA
• Remote Access Server (RAS)
• Call Manager
• Storage Array
Level 3 - Site Operations Industrial Zone
EtherNet/IP
Levels 0-2 Cell/Area Zones
Cell /Area Zone # 1 Machine System
Power Control Room MCC Sections
Cell/Area Zone #3 Electrical Distribution System
Allen-Bradley
IntelliCENTER
Section 1
Section 2
Section N
Cell/Area Zone #2 Industrial Automation & Control System
Motor Control Center

Based on the CPwE Design and Implementation Guide, publication ENET-TD001, there are limits on the amount of data latency that is acceptable on an EtherNet/IP network. These limits make sure that the network data is received when needed during critical plant processes. To make sure that the IntelliCENTER EtherNet/IP MCC lineup stays within these limits, there are MCC uplink requirements that are based on the number of industrial Ethernet switches in the lineup. Table 5 gives a brief overview of the MCC uplink requirements.

Table 5 - MCC Uplink Requirements

Chosen Topology	MCC Uplink Connection Required
Linear/Star	Every 10 industrial Ethernet Switches
Switch-level ring/Star	Every 10 industrial Ethernet Switches, extra MCC uplink connection is also required to close each switch-level ring

For IntelliCENTER EtherNet/IP MCC uplink installation instructions, refer to CENTERLINE® Motor Control Centers with EtherNet/IP Network Technical Data, publications 2100-TD031 and 2500-TD003.

MCC Uplink Industrial Ethernet Cable

The Industrial Ethernet Cable section in Chapter 2 outlined that the standard industrial Ethernet cable used throughout the IntelliCENTER EtherNet/IP MCC is the 600V UL Listed Cat 5e copper industrial Ethernet cable. Because this cable provides a robust, noise immune EtherNet/IP connection, it is often used for the uplinks to the plant-wide network, though fiber-optic Ethernet cables are another commonly used option. A fiber-optic Ethernet cable is able to transmit data easily over extreme distances and is intended for outdoor use, for example, between buildings.

The exact maximum length varies between fiber-optic cables. Consult the specifications of the fiber-optic cable being used for more information.

Table 6 - Industrial Ethernet Cable Comparison

Type of Cable	Maximum Length Between Devices
Copper Industrial Ethernet cables	100 m ((328 ft)
Fiber-optic Ethernet cables	>1 km(1) (3280 ft)

(1) Ethernet fiber-optic cable ranges vary based on composition. Consult exact cable specifications for actual maximum lengths.

Fiber-optic Ethernet cables also provide excellent immunity to electrical noises levels, achieved by the non-conductive material composition of the cable. See the Fiber Optic Infrastructure Application Guide, publication ENET-TD003 for more information about the use of a fiber-optic Ethernet cable in an EtherNet/IP architecture.

Additionally, fiber-optic Ethernet cables also provide faster uplink speeds and are sometimes required to meet network performance requirements or to support redundant EtherNet/IP topologies. For more information on fiber-optic Ethernet cable requirements for redundant EtherNet/IP topologies within the IntelliCENTER EtherNet/IP MCC, see the Resilient Ethernet Protocol (REP) section in Chapter 2.

Default EtherNet/IP Configuration - Industrial Ethernet Switches and IMC Devices

The integrated EtherNet/IP network within your IntelliCENTER EtherNet/IP MCC is preconfigured, tested, and validated at the factory before shipment, which saves you valuable onsite-commissioning time. The factory preconfigures the IP addresses and subnet masks for the industrial Ethernet switches and IMC devices using information that is provided by the customer at the time of order entry.

- Industrial Ethernet Switches
  - The Stratix 5700™ switch Express set-up wizard is used to set the IP addresses, subnet masks, and switch passwords.
  - All other Stratix 5700 switch settings remain in default configuration, which allows for the quickest integration of the IntelliCENTER EtherNet/IP MCC into the plant-wide network.

    Further configuration of the Stratix 5700 switch settings (for example, Default Gateway, Virtual Local Area Network (VLAN), and Smartport) during on-site commissioning is highly encouraged and is sometimes required to make sure the IntelliCENTER EtherNet/IP MCC appropriately integrates into the plant-wide EtherNet/IP network. See the Advanced EtherNet/IP Configuration - Industrial Ethernet Switches section for more information.
  - This configuration is the minimum set-up necessary to allow for the factory test and validation process to be completed.
  - This configuration provides the maximum flexibility when connecting the IntelliCENTER EtherNet/IP MCC to an unknown plant-wide network configuration.
- IMC Device
  - The device software is used to set the IP address and subnet mask.
  - IP addresses are not set by using the manual address switches on the IMC devices (if present).

The IP addresses and subnet masks are also loaded into the IntelliCENTER software database for future use.

IMPORTANT IP addresses and subnet masks are supplied by the customer at the time of order entry. The industrial Ethernet switch and IMC device IP addresses and subnet masks are preconfigured to test and validate the EtherNet/IP network at the factory before shipment.

Advanced EtherNet/IP Configuration - Industrial Ethernet Switches

As discussed in the Default EtherNet/IP Configuration - Industrial Ethernet Switches and IMC Devices section, the factory configuration of the industrial Ethernet switches within the IntelliCENTER EtherNet/IP MCC includes the IP addresses, subnet masks, and passwords. All other switch settings are left in the default state. This minimal configuration is used to make sure that the switch is in a state that allows for the quickest integration of the IntelliCENTER EtherNet/IP MCC into the plant-wide network. The advanced features of the Stratix 5700 managed switch provide valuable network functionality. Further configuration of the Stratix 5700 switch settings (for example, Default Gateway, Virtual Local Area Network (VLAN), and Smartport) during on-site commissioning is highly encouraged and is sometimes required to make sure the IntelliCENTER EtherNet/IP MCC appropriately integrates into the plant-wide EtherNet/IP network. The benefits of these features are described in this section. For more information on the switch and how to configure them, see the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Default Gateway

For connections to your plant-wide network that use a router or Layer 3 switch, industrial Ethernet switches and IMC devices within your IntelliCENTER EtherNet/IP MCC must have a Default Gateway configured. If the Default Gateway is not configured to reference the router or Layer 3 switch, IMC device visibility is impacted in software tools like IntelliCENTER software and Studio 5000 Logix Designer® application. See the IMC device user manual and Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007 for configuration instructions. See Additional Resources for a list of IMC device user manuals.

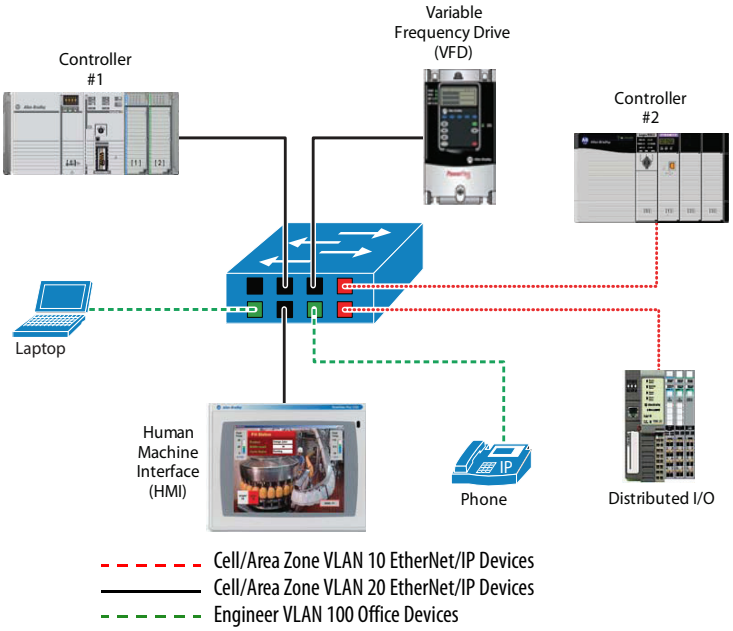
Resilient Ethernet Protocol (REP)

REP is one of the advanced features of the Stratix 5700 industrial managed Ethernet switch that provides resiliency and redundant path topology at the switch level. How REP is implemented in an IntelliCENTER EtherNet/IP MCC is described in greater detail in the Resilient Ethernet Protocol (REP) section in Chapter 2. For further information on how to configure REP in your Stratix 5700 switch, see the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Virtual Local Area Network (VLAN)

VLANs allow a network to be segmented into smaller broadcast domains without the need for extra hardware. The ability to segment into smaller broadcast domains is a vital tool for both network traffic mitigation and network security. The CPwE Design and Implementation Guide, publication ENET-TD001, emphasizes the importance of traffic mitigation to limit the effects of Layer 2 faults and broadcast traffic from occurring on the plant-wide network. These Layer 2 conditions can increase network latency and jitter, which can cause inefficiencies in a plant process. Devices that are grouped with a common set of requirements into a VLAN segments that data from interfering with other data being sent on the network. This data segmentation significantly reduces the potential of latency and jitter on that network.

Figure 16 - VLAN Diagram Example



VLANs also help to simplify the enforcement of security policies for the plant-wide network. When a VLAN is created, access ports are assigned to that specific VLAN. A VLAN is configured to allow only devices that are connected to access ports that are assigned to the same VLAN to communicate with each other. A device that is connected to an access port that is not assigned to that specific VLAN is not able to communicate to the devices on the VLAN. For further information on the configuration of VLANs in your Stratix 5700 switch, see the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Smartport

Smartport allows specific switch ports to be preconfigured for a certain type of device. This preconfiguration is done to optimize the switch port settings for common devices like automation devices, switches, routers, personal computers, and wireless devices. Smartport can be customized for specific needs that are based on the application.

As with VLANs, Smartport provides added security to the plant-wide network. One of the pre-configurations that can be applied to the port is the restriction to support only one Media Access Control (MAC) ID. This restriction of support is commonly referred to as MAC ID filtering. The MAC ID is the unique hardwired identifier for each network enabled device that is created. Because each device MAC ID is unique and unchangeable, MAC ID filtering restricts access on that port to a specific device. No unauthorized devices can gain access to the network if connected to a port that is using this Smartport feature. If appropriately configured, Smartport can provide the following:

- Optimized industrial Ethernet switch connections
- Enhanced network security
- Improved transmission quality
- Reliability of network traffic
- Port misconfiguration prevention

For further information on the configuration of Smartport in your Stratix 5700 switch, refer to the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Port Mirroring

Port mirroring, which is a Smartport feature, is a diagnostics tool that can be used in the event of network communication issues. This feature provides the ability for you to mirror all traffic on a specific switch port to a secondary switch port that is monitored by your personal computer or a diagnostics tool. When you mirror the traffic, you can observe and analyze the information that is being sent and received on a specific port without impacting that ports functionality or performance. By analyzing the mirrored port traffic, you can diagnose where an issue is potentially occurring on the plant-wide network.

For further information on the configuration of port mirroring in your Stratix 5700 switch, refer to the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Internet Group Management Protocol Snooping

Internet Group Management Protocol, or IGMP, snooping is a network traffic tool that dynamically controls the distribution of multicast traffic that is sent on the network. Multicast traffic is used when information is consumed by multiple devices on the network. If used improperly, multicast traffic can hinder network performance. IGMP snooping constrains the flooding of this traffic by dynamic switch port configuration so that multicast traffic is forwarded only to ports associated with a particular IP multicast group.

For further information on the configuration of IGMP snooping in your Stratix 5700 switch, see the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

DHCP Port Persistence

DHCP port persistence, or DHCP per port, is the feature that allows an industrial Ethernet switch to assign IP addresses to devices. The IP address that is assigned is based on the switch port they are connected to when they are initially connected to the switch. DHCP port persistence is a vital tool for industrial networks where there is a potential for devices to fail, and quick recovery is essential to prevent/limit/reduce unnecessary downtime. The port can be configured to give the device that is connected the same IP address even if the device is a replacement and has another and/or default IP address. This tool, which is used in tandem with a devices Automatic Device Configuration (ADC) functionality, provides you with an automated configuration replacement process in the event of a device failure. See Automatic Device Configuration (ADC) for more information.

For further information on the configuration of DHCP port persistence in your Stratix 5700 switch, see the Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007.

Rockwell Automation Network Services

Rockwell Automation® Network Services is available to provide guidance or on-site assistance in the implementation of these advanced Stratix 5700 switch features.

Advanced EtherNet/IP Configuration - IMC Devices

As discussed in the Default EtherNet/IP Configuration - Industrial Ethernet Switches and IMC Devices section, the factory configuration of the IMC devices includes the IP address and subnet mask. All other EtherNet/IP IMC device settings are left in the default state. This minimal configuration is done to make sure that the IMC device is in a state that allows for the quickest integration of the IntelliCENTER EtherNet/IP MCC into the plant-wide network. Advanced industrial Ethernet switch features like the ones that are described in the Advanced EtherNet/IP Configuration - Industrial Ethernet Switches section and corporate enterprise settings, require further IMC device EtherNet/IP network configuration. See the IMC device user manual for configuration instructions. See Additional Resources for a list of IMC device user manuals.

Default Gateway

For connections to your plant-wide network that use a router or Layer 3 switch, industrial Ethernet switches and IMC devices within your IntelliCENTER EtherNet/IP MCC must have a Default Gateway configured. If the Default Gateway is not configured to reference the router or Layer 3 switch, IMC device visibility is impacted in software tools like IntelliCENTER software and Studio 5000 Logix Designer application. See the IMC device user manual and Stratix 5700 Ethernet Managed Switches User Manual, publication 1783-UM007 for configuration instructions. See Additional Resources for a list of IMC device user manuals.

Automatic Device Configuration (ADC)

If an IMC device fails, the typical procedure requires an engineer or technician to have the information about the device that is being replaced including the IP address, firmware revision, and device parameters. The engineer or technician must also have the skillset and tools that are required to update the new IMC device with this information. The process to gather all this information and enter it into the replacement IMC device can take an extended period, which results in unnecessary plant downtime. With ADC and Studio 5000 Logix Designer firmware supervisor enabled and configured for intelligent devices and a Stratix 5700 managed switch with DHCP port persistence enabled, an engineer or technician only has to replace the device. The IP address, firmware revision, and device parameters are immediately and automatically pushed to the device, significantly reducing the plant downtime to a matter of minutes. To take advantage of the downtime savings that ADC can provide, the architecture must include the following:

√ - Logix controller with ADC and firmware supervisor enabled

√ - IMC devices that support ADC

√ - Stratix 5700 industrial managed Ethernet switch with DHCP port persistence enabled

Figure 17 shows how easy it is to replace an IMC device with ADC enabled.

Figure 17 - Automatic Device Configuration Example

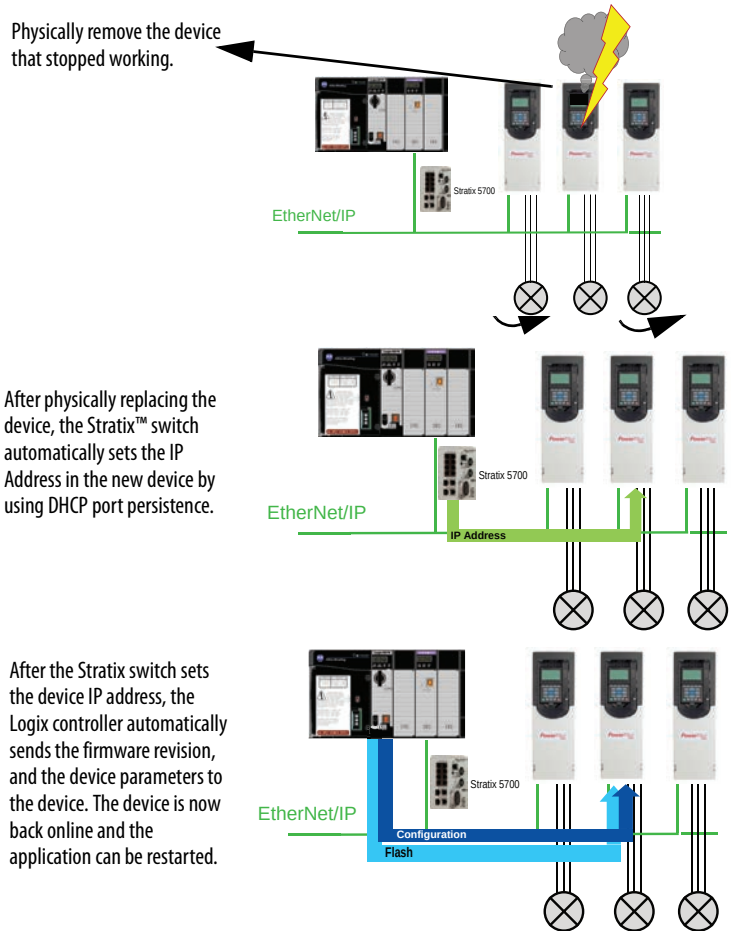

Physically remove the device that stopped working.
Stratix 5700
EtherNet/IP
After physically replacing the device, the Stratix™ switch automatically sets the IP Address in the new device by using DHCP port persistence.
Stratix 5700
EtherNet/IP
IP Address
After the Stratix switch sets the device IP address, the Logix controller automatically sends the firmware revision, and the device parameters to the device. The device is now back online and the application can be restarted.
Stratix 5700
EtherNet/IP
Configuration
Flash

Table 7 provides an overview of which IMC device EtherNet/IP communication cards provide ADC functionality. The IP address reassignment for these devices is automatic.

Table 7 - Single Port EtherNet/IP Communication Interfaces

Product	Interface
PowerFlex® 753 Variable Frequency Drive	20-750-ENETR
PowerFlex 755 Variable Frequency Drive	20-750-ENETR
PowerFlex 755 Variable Frequency Drive	Embedded EtherNet/IP communication
PowerFlex 525 Variable Frequency Drive	Embedded EtherNet/IP communication
PowerFlex 523 Variable Frequency Drive	25-COMM-E2P
E300™ Overload Relay	Embedded EtherNet/IP communication

See the IMC device user manual for ADC configuration instructions. See Additional Resources for a list of IMC device user manuals. See the DHCP Port Persistence section for information on the configuration of the industrial Ethernet switch for ADC.

Options for IMC Device EtherNet/IP Configuration

Many IMC devices support multiple EtherNet/IP configuration methods, including BOOTP/DHCP server software, device web pages, Studio 5000 Logix Designer Add-on Profiles (AOPs), device HMIs, and IntelliCENTER software Monitor views. This flexibility lets you choose the appropriate configuration methodology for your device and application.

BOOTP/DHCP Server

The Bootstrap Protocol (BOOTP)/Dynamic Host Configuration Protocol (DHCP) server is a standalone server that you can use to set the IP address of an IMC device. When used, the BOOTP/DHCP server sets an IP address and other Transport Control Protocol (TCP) parameters.

You can use the BOOTP/DHCP server to set the IP address of the device if one of these conditions exists at powerup:

- The rotary switches on the device are not set to a number and the device is BOOTP/DHCP enabled.
- The device does not have rotary switches and the device is BOOTP/DHCP enabled.

Access the BOOTP/DHCP server from the tools directory on the Studio 5000 environment installation CD.

IMPORTANT	Before you start the BOOTP/DHCP server, make sure that you have the hardware (MAC) address for the device. The hardware address is typically on a sticker on the side of the communication module and uses an address in a format similar to the following: 00-00-BC-14-55-35

See the EtherNet/IP Network Configuration User Manual, publication ENET-UM001, for more information.

Using the IMC Device Web Page for IMC Device Configuration

Some EtherNet/IP IMC devices support a device web page. The device web page functionality varies by device, but can include EtherNet/IP address configuration including IP address, subnet mask, and Default Gateway configuration.

Table 8 - Web Page Functionality

MCC EtherNet/IP Device	Supports Web Page	Use Web Page to Set IP Address	Use Web Page to View Status Information	Use Web Page to Configure Parameters
825-P Motor Relay	No	No	No	No
857 Motor and Feeder Protection Relay	No	No	No	No
E1™ Overload Relay	Yes	Yes	Yes	Limited
E3 ™ Overload Relay via 2100-ENET Module	No	No	No	No
E300 Overload Relay	Yes	Yes	Yes	Yes
PowerMonitor™ 500 Unit	No	Yes	Yes	Yes
PowerMonitor™ 1000 Unit	Yes	Yes	Yes	Yes
PowerMonitor 5000 Unit	Yes	Yes	Yes	Yes
POINT I/O™ AENT Module	Yes	Yes	Yes	Limited
PowerFlex 40 or 400 Drive	Yes	Yes	Yes	Limited
PowerFlex 525 Drive	No	No	No	No
PowerFlex 70 or 700 Drive	Yes	Yes	Yes	Limited
PowerFlex 753 or 755 Drive	Yes	Yes	Yes	Limited
SMC™ Flex Controller	Yes	Yes	Yes	Limited

See the IMC device user manual for information about the device web pages. See Additional Resources for a list of IMC device user manuals.

Using the Studio 5000 Logix Designer Application for IMC Device Configuration

Each IMC device can be added to a Studio 5000 Logix Designer project. Most devices use Add-on Profiles (AOPs), which provide advanced configuration options in the Logix Designer application. Additionally, device status can be viewed in the Logix Designer application. AOP support varies by IMC device. Configuration and status functionality varies by the type of AOP that the device supports.

IntelliCENTER software Logix Designer Integration Assistant can be used to populate the AOP automatically in Logix Designer, which saves you valuable time during commissioning. See the IntelliCENTER Software Integration Assistant for Logix Designer section.

Table 9 - Studio 5000 Logix Designer Add-on Profile Functionality

MCC EtherNet/IP Device	Generic AOP	Custom AOP	Use AOP to Set IP Address	Use AOP for Full Parameter Support
825-P Motor Relay	Yes	No	Yes	No
857 Motor and Feeder Protection Relay	Yes	No	Yes	No
E1 Overload Relay	No	Yes	Yes	No
E3 Overload Relay via 2100-ENET module	No	Yes	Yes	No
E300 Overload Relay	No	Yes	Yes	No
PowerMonitor 1000 Unit	Yes	No	Yes	No
PowerMonitor 5000 Unit	Yes	No	Yes	No
POINT I/O AENT module	No	Yes	Yes	Limited
PowerFlex 40 or 400 Drive	No	Yes	Yes	Yes
PowerFlex 525 Drive	No	Yes	Yes	Yes
PowerFlex 70 or 700 Drive	No	Yes	Yes	Yes
PowerFlex 753 or 755 Drive	No	Yes	Yes	Yes
SMC Flex Controller	No	Yes	Yes	Yes

See the IMC device user manual for information about the device AOP functionality. See Additional Resources for a list of IMC device user manuals.

Using the IntelliCENTER Software Monitor View for IMC Device Configuration

IntelliCENTER software supports most IMC devices and provides a customized Monitor view for device status and configuration. Monitor view support and functionality varies by IMC device. The parameters that are available in the device electronic data sheet (EDS) file specify the device-parameter configuration functionality within the Monitor View.

Table 10 - IntelliCENTER Software Monitor View Functionality

MCC EtherNet/IP Device	Supports Monitor View	Use Monitor View to Access Web Page	Use Monitor View to Set IP Address	Use Monitor View to View Status Information	Use Monitor View to Configure Parameters
825-P Motor Relay	Yes	No	Yes (S)(1)	Yes	Yes
857 Motor and Feeder Protection Relay	Yes	No	No	Yes	Yes
E1 Overload Relay	Yes	Yes	Yes (S/W)	Yes	Yes
E3 Overload Relay via 2100-ENET Module	Yes	No	Yes (S)	Yes	Yes
E300 Overload Relay	Yes	Yes	Yes (S/W)	Yes	Yes
PowerMonitor 1000 Unit	No	Yes	Yes (W)	No	No
PowerMonitor 5000 Unit	Yes	Yes	Yes (W)	Yes	Yes
POINT I/O AENT module	Yes	Yes	Yes (S)	Yes	Yes
PowerFlex 40 or 400 Drive	Yes	Yes	Yes (W/M)	Yes	Yes
PowerFlex 525 Drive	Yes	No	Yes (W/M)	Yes	Yes
PowerFlex 70 or 700 Drive	Yes	Yes	Yes (W/M)	Yes	Yes
PowerFlex 753 or 755 Drive	Yes	Yes	Yes (W/M)	Yes	Yes
SMC Flex Controller	Yes	Yes	Yes (W/M)	Yes	Yes

(1) S = spreadsheet view, W = web page, M = new monitor view.

For further information on IntelliCENTER software, see the IntelliCENTER Software section.

Logix Controller Connection Considerations

When connecting an IntelliCENTER EtherNet/IP MCC to a Logix controller architecture, take care when mapping the EtherNet/IP devices within the MCC to the Logix controller and EtherNet/IP communication card. Follow the best practice guidelines around EtherNet/IP devices per Logix controller and EtherNet/IP devices per EtherNet/IP communication card to make sure that your EtherNet/IP network and Logix controller performance is not negatively impacted by overloading the controller or communication card.

See the Advanced EtherNet/IP capacity tool embedded in the Integrated Architecture® Builder (IAB) software to apply these guidelines when integrating your IntelliCENTER EtherNet/IP MCC into a Logix Controller architecture. http://raiseinstall.rockwellautomation.com/pst-lite.html

IntelliCENTER Software

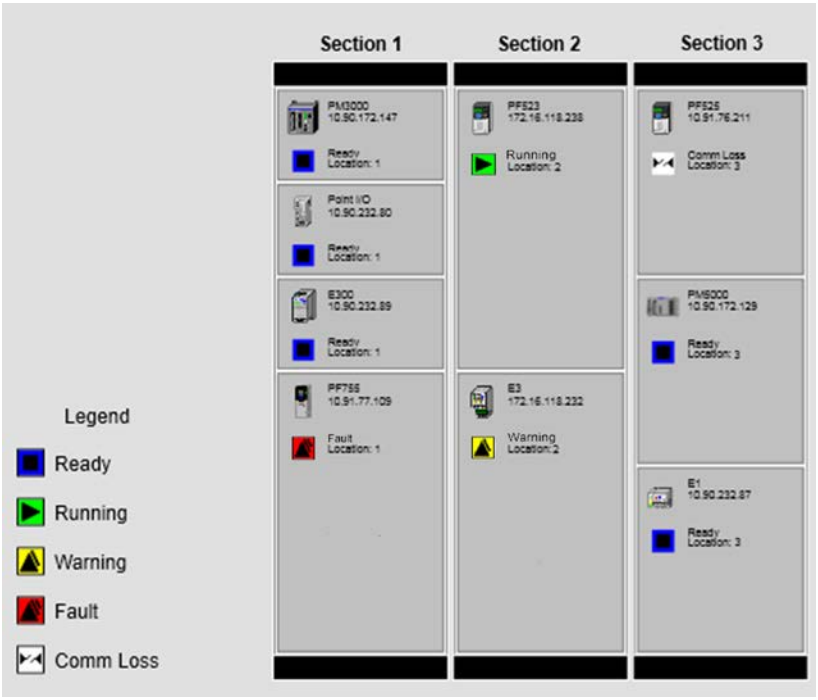
The IntelliCENTER software package is customized to your particular IntelliCENTER EtherNet/IP MCC configuration. The software provides a customized virtual environment that allows you to access your IMC device information over the integrated EtherNet/IP network in your MCC. The software provides a system level dashboard, which is a graphical representation of your MCC. Individual views of each IMC device provide monitoring and configuration functionality. This functionality lets you monitor your IMC device real-time diagnostics, which can help you troubleshoot and/or predict issues with your process or application. IMC device information and diagnostics can be remotely accessed without having to shut-down, lockout, or remove the device. Intermittent problems can be captured and analyzed by using trend and event logging capabilities. Alarm, warning, and fault notifications can be emailed as needed. ActiveX Controls provide integration with on-machine HMI. Integrated asset management functionality provides critical documentation for your MCC when you need it. Embedded integration assistant tools provide seemless connection to the Logix Designer application and FactoryTalk® EnergyMetrix™ software. This section further details the IntelliCENTER software functionality.

System Level Dashboard

The system level dashboard, in the IntelliCENTER software, is a graphical representation of your entire MCC lineup. The condition of each IMC device within an MCC unit is quickly observed with status light indicators that change color to indicate ready, running, warning, fault, or off-line status conditions. Customizable text on each MCC unit provides instant identification of the IMC device, machine, or process. The system level dashboard lets you do the following:

- View a virtual representation of the MCC
- Determine the condition of the motor controls in the MCC
- Navigate to units by selecting them
- Rearrange the virtual representation of the MCC lineup to reflect any physical changes that are made to your MCC
- Change how your MCC lineup is displayed to reflect a more logical or process-centric view in place of the default physical layout-view

Figure 18 - IntelliCENTER Software System Level Dashboard Example



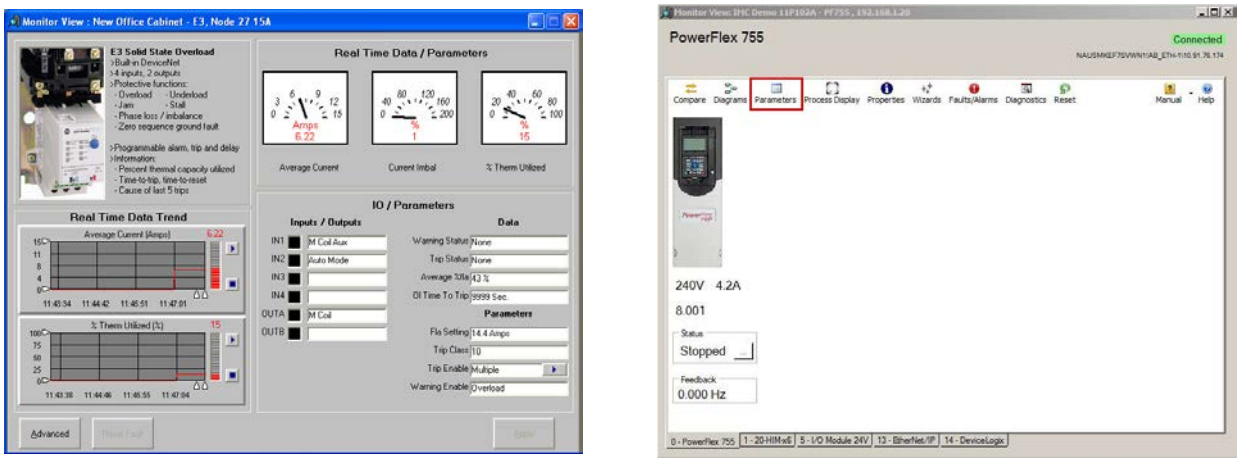
For further information on the system level dashboard in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

IMC Device Monitoring and Configuration

The Monitor view, in IntelliCENTER software, displays an overview of the IMC device being monitored. The display includes configurable analog gauges, configurable trend graphs, status of I/O on the device, and configurable data fields. The Monitor view functionality allows you to:

- Monitor parameters from the IMC devices
- Configure device parameters, including IP addresses and Subnets
  - See Using the IntelliCENTER Software Monitor View for IMC Device Configuration for more information
- Record up to 5000 data points with the trend graph and export them to a .csv file

Figure 19 - IntelliCENTER Software Monitor View Examples



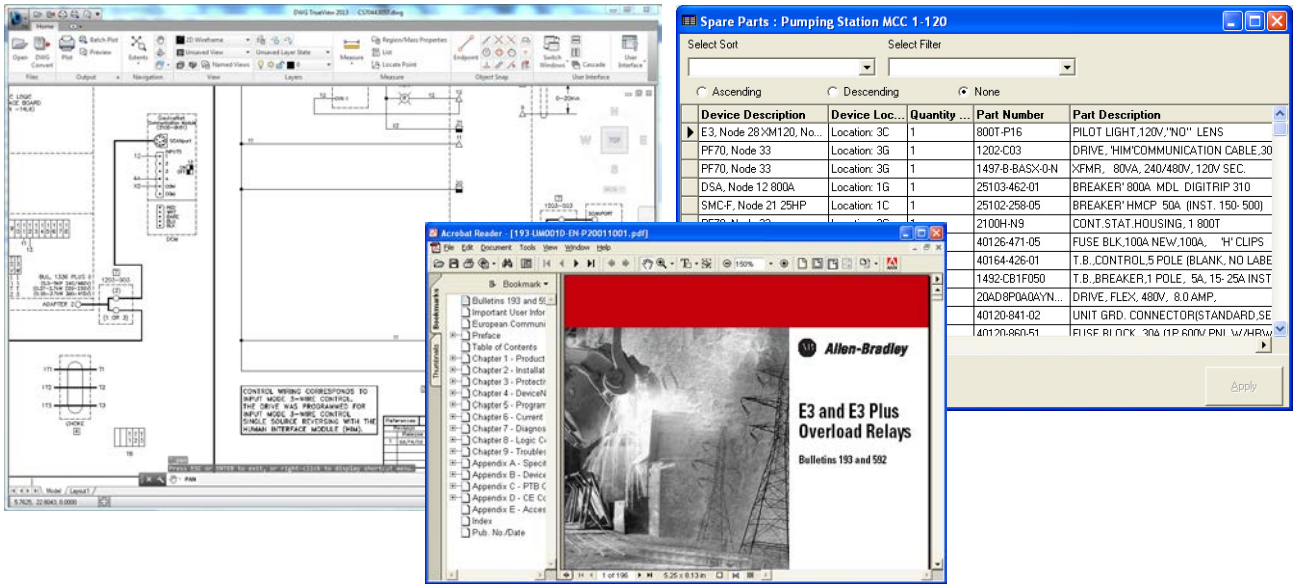
For further information on the monitoring and configuring of IMC devices in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

Asset Management

IntelliCENTER software includes a complete set of documentation of your MCC. Spare parts lists, wiring diagrams, and IMC device manuals are all available in electronic form and are readily available and easily accessible via IntelliCENTER software when they are needed most:

- Troubleshoot problems by using the exact manuals that were shipped with your MCC
- Trace out wiring and understand control circuits by using wiring diagrams
  - These diagrams can be altered to reflect installation changes and saved back to the software for future use.
- Add new documentation (for example, procedures and engineering notes) associated with the unit or the lineup
- Review event logs
- View and manage unit-specific spare parts list
  - Add your part number scheme and alter items such as parts, and quantities

Figure 20 - IntelliCENTER Software Documentation Examples

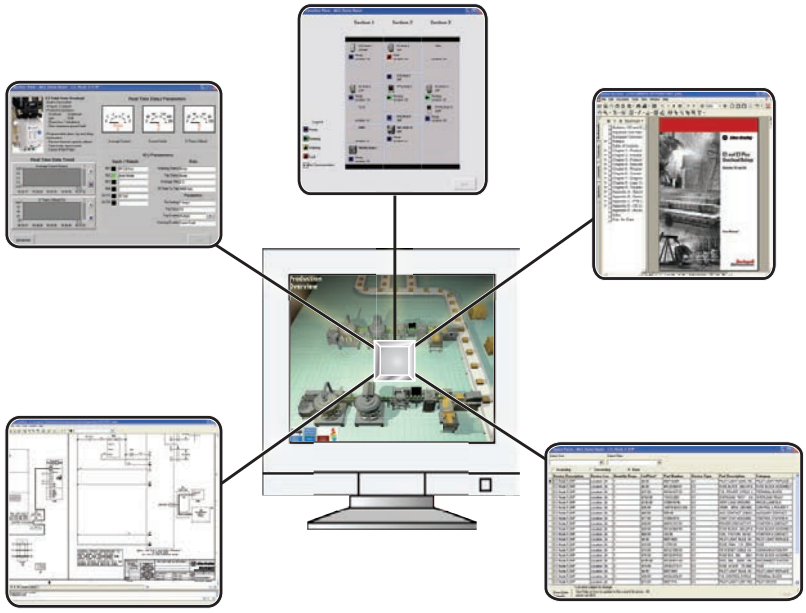


For further information on asset management in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

Computer and HMI Support

IntelliCENTER software can be run on a computer, laptop, or HMI and can access multiple MCC lineups simultaneously. Devices running IntelliCENTER software can each manage their own individual, local copies of the MCC lineup data. Alternatively, a server can manage one, unified copy of the MCC lineup data. Each device running IntelliCENTER software can access the MCC lineup data from that server. ActiveX objects for each IntelliCENTER software view let you access IntelliCENTER software functionality from HMIs located wherever your MCC plant requires. The flexibility of IntelliCENTER software lets you define how you want to manage your MCC lineup data. It also lets you remotely access your critical MCC lineup information from the appropriate device at that particular time.

Figure 21 - IntelliCENTER Software HMI Example



For further information on HMI support in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

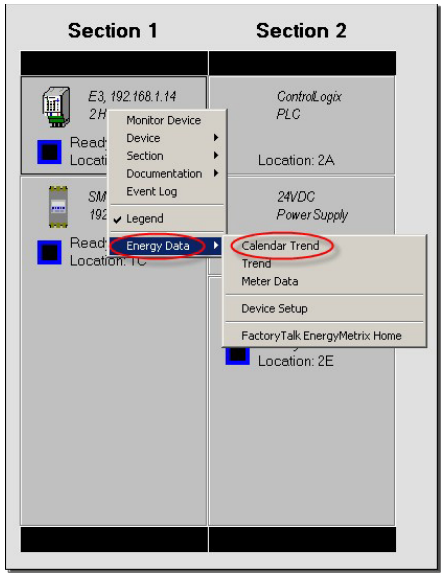
IntelliCENTER Energy

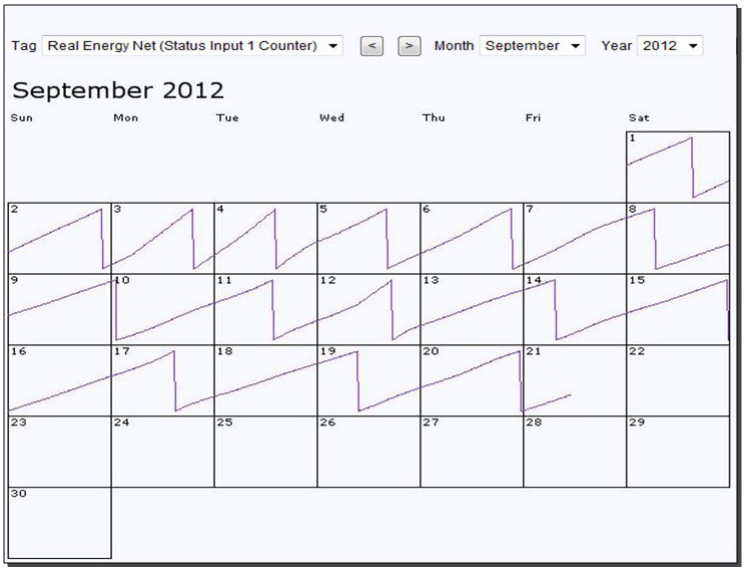
IntelliCENTER Energy is a premier software package that includes the features of IntelliCENTER software with extra energy-management benefits provided by FactoryTalk® EnergyMetrix™ software. This package provides the following:

- Real-time energy consumption and historical trending down to the IMC device level, all across the EtherNet/IP network.
- Ability to monitor historic energy usage, which can provide valuable process and device energy information that can lead to substantial cost savings.
- Customizable real-time energy views accessible directly in IntelliCENTER software

The calendar trend can show key energy values over time so you can see how your application is consuming energy.

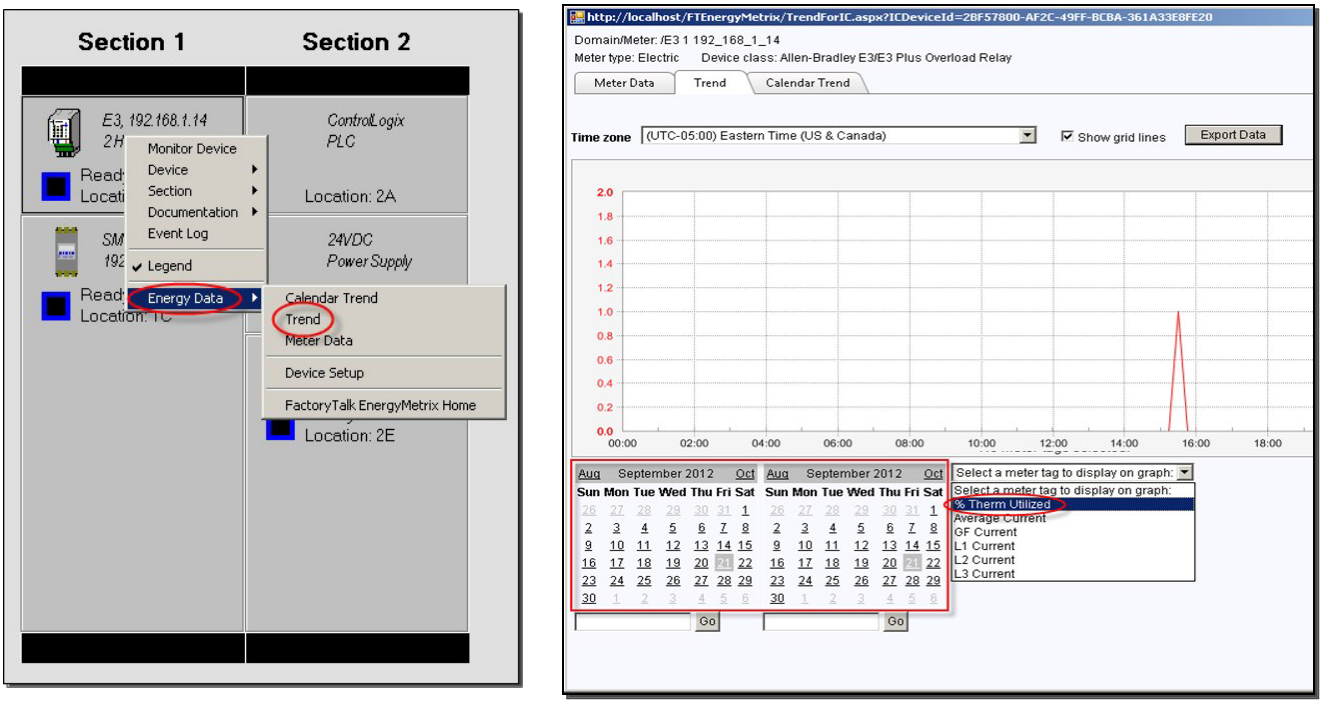
Figure 22 - IntelliCENTER Energy Calendar View Example





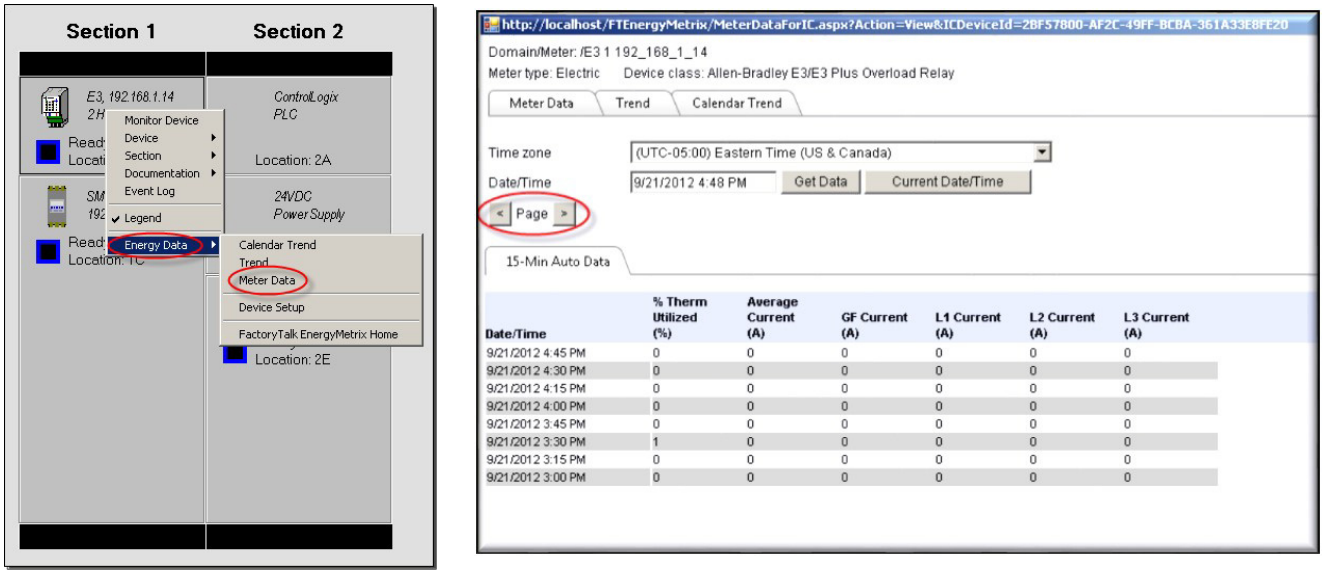
Simultaneously collect energy data for any time period (hourly, daily, weekly, and monthly). Trend key parameters and export the data for recordkeeping or further analysis. Use the data to determine how application, production schedule, or MCC changes affect your energy consumption.

Figure 23 - IntelliCENTER Energy Trend View Example



View all key energy values for a particular device on one screen by using the Meter Data view.

Figure 24 - IntelliCENTER Energy Meter Data View Example



For further information on IntelliCENTER Energy in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

IntelliCENTER Software Integration Assistant for Logix Designer

IntelliCENTER software offers an Integration Assistant for the Studio 5000 Logix Designer application. Integration Assistant automates the integration of IMC devices within your IntelliCENTER EtherNet/IP MCC into a ControlLogix®or CompactLogix™ controller. Integration Assistant functionality includes the following:

- Adds the IMC devices in your MCC lineup to the Logix controller I/O tree and gets the controller tags ready for programming.
  - The tool saves you the time that it takes to add each device manually to the I/O tree and gets you ready for control programming as quickly as possible.
- IMC Device configurations are automatically imported including the device type, device name, IP address, subnet mask, and auto-generated device tags via the device Add-on Profile (AOP).

For further information on Logix Designer Integration Assistant in IntelliCENTER software, see the IntelliCENTER Software User Manual, publication MCC-UM002.

IntelliCENTER EtherNet/IP MCC Expansion

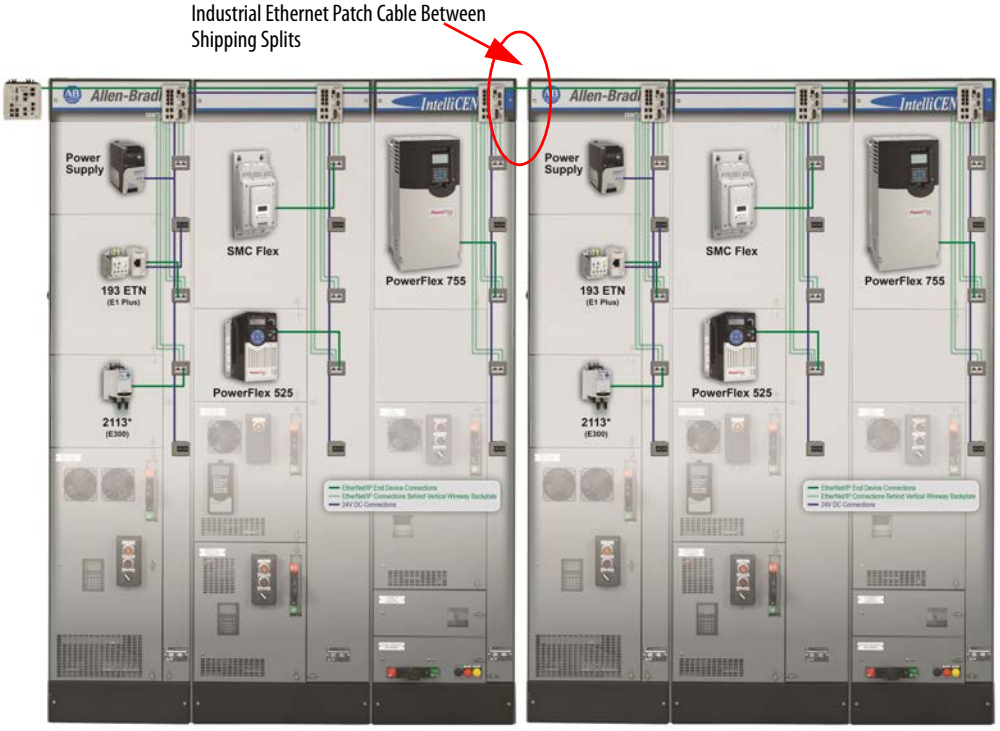
Motor Control Centers have an expectation to remain in service for many years in a plant facility. This expectation carries many requirements; the ability to expand to accommodate plant or process changes and backward and forward compatibility. The IntelliCENTER® EtherNet/IP MCC meets these requirements by providing a flexible and expandable solution. This chapter provides information on the methods and abilities to expand your IntelliCENTER EtherNet/IP MCC through the life of your plant.

Adding IntelliCENTER EtherNet/IP Sections to an Existing MCC Lineup

You can connect multiple IntelliCENTER EtherNet/IP MCC shipping splits to expand your MCC lineup. Expansion is achieved by connecting the industrial Ethernet switch from the last section in the existing MCC lineup to the industrial Ethernet switch in the first section of the next shipping split. An industrial Ethernet patch cable is used to connect the two switches.

This same method is used when connecting new MCC sections to the IntelliCENTER EtherNet/IP MCC in the future. Be sure to consider the EtherNet/IP addressing scheme that is used in the existing lineup when specifying the IP Addresses and subnet masks for the new sections.

Figure 25 - Connect New MCC Sections



IMPORTANT See the MCC Uplink to Plant-wide Network section in Chapter 3 for guidelines on how many industrial Ethernet switches can be connected together in a linear or switch-level-ring topology. These guidelines determine whether the first industrial Ethernet switch in the MCC sections to be added connects to the last industrial Ethernet switch in the existing MCC lineup or whether a new MCC uplink connection is used instead.

For more information on the addition of IntelliCENTER EtherNet/IP MCC sections to an existing MCC lineup, see the CENTERLINE® Motor Control Center with EtherNet/IP Network Technical Data, publications 2100-TD031 and 2500-TD003.

If you are using IntelliCENTER software, make sure to order a software database so the new IntelliCENTER EtherNet/IP MCC sections can be represented in IntelliCENTER software alongside the existing MCC lineup. The software database provides access to the Elevation view, Monitor view, and documentation for the new MCC sections as explained in the IntelliCENTER Software section in Chapter 3.

Adding IntelliCENTER EtherNet/IP Units to an Existing MCC Lineup

IntelliCENTER EtherNet/IP units can be added to an existing MCC lineup, but EtherNet/IP connectivity and 24V DC power capacity has to be considered.

EtherNet/IP connectivity considerations for horizontal wireway-mounted Ethernet switches: As described in the EtherNet/IP Network and 24V DC Connections within a Shipping Split section in Chapter 2, the plug-in sections of an IntelliCENTER EtherNet/IP MCC are designed to accommodate up to eight EtherNet/IP devices in one section via ease of use EtherNet/IP wireway adapters. Therefore, if there are any blank space factors in a section, a new IntelliCENTER EtherNet/IP plug-in unit that requires an EtherNet/IP connection can be purchased and easily installed. The EtherNet/IP connection uses either an EtherNet/IP adapter in the vertical wireway of a CENTERLINE 2100 IntelliCENTER MCC or the automatic mounting EtherNet/IP connection in a CENTERLINE 2500 MCC.

EtherNet/IP connectivity considerations for unit-mounted Ethernet switches: As described in the EtherNet/IP Network and 24V DC Connections within a Shipping Split section in Chapter 2, the IntelliCENTER EtherNet/IP MCC sections with plug-in units, and unit-mounted switches use homerun Ethernet cable connections instead of vertical wireway Ethernet adapters. Therefore, if there are any spare Stratix 5700™ ports in a switch-unit, then IntelliCENTER EtherNet/IP units can be purchased and easily installed. The desired number of spare switch ports must be accounted for at order entry for the appropriate switch unit. Otherwise, additional units require an additional Ethernet switch to connect to.

Regardless of where the Ethernet switch is mounted in the MCC lineup, if more units are purchased, tell your local Allen-Bradley distributor or Rockwell Automation sales representative that the unit is going into an IntelliCENTER EtherNet/IP MCC and provide the appropriate IP address and subnet mask information. When you notify them, the unit arrives with the IP Address and subnet mask configured appropriately.

LVMCC Solution	EtherNet/IP Ready Unit Provision
CENTERLINE 2100	Industrial Ethernet patch cable provided
CENTERLINE 2500	EtherNet/IP plug-in unit

24V DC power capacity considerations: As described in the EtherNet/IP Network and 24V DC Connections section in Chapter 2, the plug-in sections of an IntelliCENTER EtherNet/IP MCC incorporate an integrated 24V DC power supply. The integrated 24V DC power provides ease of use connections for IntelliCENTER EtherNet/IP plug-in units that require 24V DC power for EtherNet/IP communication options. If the unit being added requires 24V DC power, the 24V DC connection uses either a 24V DC power adapter in the vertical wireway of a CENTERLINE 2100 IntelliCENTER MCC or the automatic mounting 24V DC connection in a CENTERLINE 2500 MCC. Take care to make sure that the integrated 24V DC power has enough available capacity to support the new unit.

For more information on the addition of IntelliCENTER EtherNet/IP units to an existing lineup, including information on how to determine the available capacity of the integrated 24V DC power supplies, see the CENTERLINE Motor Control Center with EtherNet/IP Network Technical Data, publications 2100-TD031 and 2500-TD003.

If you are using IntelliCENTER software, make sure to order a unit software database so the new IntelliCENTER EtherNet/IP MCC plug-in unit can be represented in IntelliCENTER software alongside the existing MCC units. The software database provides access to the Elevation view, Monitor view, and documentation for the new MCC unit as explained in the IntelliCENTER Software section in Chapter 3.

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Rockwell Automation Support

Rockwell Automation provides technical information on the Web to assist you in using its products. At http://www.rockwellautomation.com/support you can find technical and application notes, sample code, and links to software service packs. You can also visit our Support Center at https://rockwellautomation.custhelp.com/ for software updates, support chats and forums, technical information, FAQs, and to sign up for product notification updates.

In addition, we offer multiple support programs for installation, configuration, and troubleshooting. For more information, contact your local distributor or Rockwell Automation representative, or visit http://www.rockwellautomation.com/services/online-phone.

Installation Assistance

If you experience a problem within the first 24 hours of installation, review the information that is contained in this manual. You can contact Customer Support for initial help in getting your product up and running.

United States or Canada	1.440.646.3434
Outside United States or Canada	Use the Worldwide Locator at http://www.rockwellautomation.com/rockwellautomation/support/overview.page, or contact your local Rockwell Automation representative.

New Product Satisfaction Return

Rockwell Automation tests all of its products to help ensure that they are fully operational when shipped from the manufacturing facility. However, if your product is not functioning and needs to be returned, follow these procedures.

United States	Contact your distributor. You must provide a Customer Support case number (call the phone number above to obtain one) to your distributor to complete the return process.
Outside United States	Please contact your local Rockwell Automation representative for the return procedure.

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Rockwell Otomasyon Ticaret A.Ş., Kar Plaza İş Merkezi E Blok Kat:6 34752 İçerenköy, İstanbul, Tel: +90 (216) 5698400

www.rockwellautomation.com

Power, Control and Information Solutions Headquarters

Americas: Rockwell Automation, 1201 South Second Street, Milwaukee, WI 53204-2496 USA, Tel: (1) 414.382.2000, Fax: (1) 414.382.4444
Europe/Middle East/Africa: Rockwell Automation NV, Pegasus Park, De Kleetlaan 12a, 1831 Diegem, Belgium, Tel: (32) 2 663 0600, Fax: (32) 2 663 0640
Asia Pacific: Rockwell Automation, Level 14, Core F, Cyberport 3, 100 Cyberport Road, Hong Kong, Tel: (852) 2887 4788, Fax: (852) 2508 1846

Publication MCC-RM001B-EN-P - October 2015
Supersedes Publication MCC-RM001A-EN-P - March 2015

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